MASSACHUSETTS DEPARTMENT OF PUBLIC HEALTH

Commissioner of Public Health, Paul J. Jakmauh, M.D.

Public Health Council

Paul J. Jakmauh, M.D., *Chairman*

R. Nelson Hatt, M.D.
Gordon Hutchins
Francis H. Lally, M.D.
Richard M. Smith, M.D.
Richard P. Strong, M.D.
James L. Tighe, B.A.Sc., C.E.

Florence L. Wall, *Secretary*

Division of Administration	Under direction of Commissioner
Division of Tuberculosis	*Director* and *Deputy Commissioner*, Alton S. Pope, M.D.
Division of Adult Hygiene	*Director*, Herbert L. Lombard, M.D.
Division of Biologic Laboratories	*Director*, Elliott S. Robinson, M.D.
Division of Child Hygiene	*Director*, M. Luise Diez, M.D.
Division of Communicable Diseases	*Director*, Roy F. Feemster, M.D.
Division of Food and Drugs	*Director*, Hermann C. Lythgoe, S.B.
Division of Genitoinfectious Diseases	*Director*, Nels A. Nelson, M.D.
Division of Sanitary Engineering	*Director*, Arthur D. Weston, C.E.

Assistant to the Commissioner, John J. Poutas, M.D.

State District Health Officers

Northeastern District	Robert E. Archibald, M.D.
North Metropolitan District	Served by Central Office
South Metropolitan District	Henry M. DeWolfe, M.D.
Southeastern District	Harold W. Stevens, M.D.
Worcester District	Oscar A. Dudley, M.D.
North Connecticut Valley District	Walter W. Lee, M.D.
South Connecticut Valley District	Charles E. Gill, M.D.
Berkshire District	Frank B. Carroll, M.D.

Institutions and Superintendents

Lakeville State Sanatorium	Leon A. Alley, M.D.
North Reading State Sanatorium	Carl C. MacCorison, M.D.
Rutland State Sanatorium	Ernest B. Emerson, M.D.
Westfield State Sanatorium	Roy Morgan, M.D.
Pondville Hospital	George L. Parker, M.D.

The Commonwealth of Massachusetts

Department of Public Health
State House, Boston, January 8, 1941.

To the Honorable Senate and House of Representatives:

In accordance with the provisions of Section 32 of Chapter 30, General Laws, I have the honor to submit herewith the annual report of the Department of Public Health for the year ended November 30, 1940.

Respectfully submitted,
Paul J. Jakmauh, M.D.,
Commissioner of Public Health.

TWENTY-SIXTH ANNUAL REPORT

OF THE

DEPARTMENT OF PUBLIC HEALTH OF MASSACHUSETTS

REPORT OF THE PUBLIC HEALTH COUNCIL

At the end of the fiscal year closing November 30, 1940, the Department of Public Health was constituted as follows:

Commissioner of Public Health, Paul J. Jakmauh, M.D.

Public Health Council

R. Nelson Hatt, M.D., 1945	Richard M. Smith, M.D., 1943
Gordon Hutchins, 1944	Richard P. Strong, M.D., 1941
Francis H. Lally, M.D., 1942	James L. Tighe, B.A.Sc., C.E., 1941

Regular monthly meetings of the Department have been held throughout the year, the June meeting being held at the Lakeville State Sanatorium and the October meeting at the Westfield State Sanatorium, at which time inspections were made of these institutions. Special meetings were also held in October and November. In connection with the June meeting a visit was made to the demonstration and exhibit of plumbing and protective equipment at the New Bedford Vocational School, followed by an inspection of the Massachusetts National Guard Military Reservation in Bourne and Falmouth. Nine public hearings were held as provided by statute, relative to approval of the taking of certain lands for the protection of water supplies, the acquisition of a sewerage system and sewage disposal works by a town, an alleged nuisance caused by the keeping of mink, and appeals from actions of local boards of health in refusing to grant permits to sell milk.

The Committee on Sanitary Engineering, composed of Mr. Tighe, Chairman, Mr. Hutchins and the Commissioner, has usually met each month prior to the regular meeting of the Council and submitted its recommendations on all matters of sanitary significance.

The following investigations have been conducted in accordance with legislative resolves of 1939: Chapter 14, providing for an investigation by the Department, in co-operation with the Federal Works Progress Administration, relative to the varieties and prevalence of certain kinds of mosquitoes in the Commonwealth; Chapter 26, providing for an investigation by the Department relative to means and methods of remedying the pollution of Martin's Pond in the town of North Reading; and Chapter 54, providing for an investigation by a joint board consisting of this Department and the State Reclamation Board relative to the protection of the public health and relief from the mosquito nuisance in a certain section of the Charles River Valley. Reports of these investigations have been filed with the Clerk of the House, as ordered, and reference to them will be made in other parts of this report. In accordance with Chapter 22 of the Resolves of 1939, the Department has co-operated with the Federal Work Projects Administration in the compilation of reports relative to the sanitary condition of certain rivers in the Commonwealth.

The Council has carried out its regular duties as imposed by law, including the revision of the Department's regulations relative to the sale of surplus biologic products and relative to the control of gonorrhea and syphilis; renewal of a contract with the Massachusetts General Hospital for the care of persons suffering from chronic rheumatism; determination of polluted areas and restrictions on the taking of shellfish therefrom; granting of licenses for the conduct of dispensaries; approval of laboratories, of subsidy to cancer clinics, of contracts for the production of certified milk, of appointments of medical personnel at State and county tuberculosis sanatoria, of renewal contracts between counties for the care of tuberculosis patients at county sanatoria, of clarified rules and regulations of the State Board of Examiners of Plumbers, of additional rules and regulations for the protection of the Metropolitan water supply, and of out-of-state shellfish dealers who have been approved by their respective state shellfish authorities and the United States Public Health Service.

TWENTY-SIXTH ANNUAL REPORT OF THE COMMISSIONER OF PUBLIC HEALTH

To the Public Health Council:

Gentlemen: I have the honor to submit my annual report for the fiscal year ending November 30, 1940.

I. Administration

During the year the Department continued to be represented at regular meetings of the following boards:

Approving Authority, consisting of the Secretary of the Board of Registration in Medicine, the Commissioner of Education, and the Commissioner of Public Health, to consider standards for medical schools and graduates thereof;

State Planning Board, consisting of the Commissioners of Conservation, Public Health and Public Works, and six appointive members;

Rating Board, consisting of the Surgeon General of the Commonwealth, the Commissioner of Public Health, and the Commissioner of Public Safety, to consider the retirement of members of the State Police;

Reclamation Board, consisting of representatives of the State Departments of Public Health and Agriculture; and the

Joint Board, consisting of the Departments of Labor and Industries and Public Health, to consider the hours of labor of women and children employed in hospitals and similar institutions.

The Department organization for disaster relief, although fortunately not called on for any emergency during the year, has been maintained and is revised from time to time to keep abreast with current activities.

National Defense.— At the request of the Surgeon General of the United States Public Health Service in September, I attended a meeting of the State Health Officers in Washington, called to consider plans for a national defense program in relation to public health. The following resolution was presented by me at that time:

RESOLUTION.— "To avoid the creation of hazards to the public health of populations in the vicinity of military and naval bases, training areas, war industries plants, etc., by reason of endangering public water supplies or by the discharge of inadequately treated domestic or industrial sewage from such centers, and;

"To enable the State Health Departments, as charged by law, to maintain definite standards of safety for public water supplies and adequacy of treatment of domestic and industrial sewage for the protection of the public health;

"We request that the Surgeon General of the Public Health Service cause to be brought to the attention of the responsible heads of the Defense agencies — war, naval, and industrial — the necessity for prompt adoption of procedures whereby the public water supply and waste disposal facilities of these concentrations of forces of the National Defense program will conform to the standards of the Department of Health of the State in which such facilities may be located."

This resolution was later adopted and presented to the military authorities. Under date of September 28, 1940, the War Department through the office of the Quartermaster General issued a general order in the matter. The construction activities at Camp Edwards in Falmouth and Bourne, Fort Devens in Ayer, and Westover Field in Chicopee and Ludlow have resulted in a great increase in the work of the engineering staff of the Department and at the end of the year at the request of the United States Army the Department is making certain maps indicating the strategic points in connection with water works systems and sewage disposal works which should be protected during an emergency.

At the Washington conference also the question of responsibility after discovery of cases of tuberculosis and genitoinfectious disease among draftees and enlisted men was given careful consideration. The routine blood testing of draftees as a part of their preinduction physical examination and of members of the National Guard indicates only about .6 per cent of syphilitic infection which would seem to confirm our feeling that the prevalence of syphilis in Massachusetts is confined to less than one per cent of the population.

The Department through its district representatives has been attempting to keep in close touch with the local boards of health of communities adjacent to military camps in order to prevent the spread of any communicable disease should it occur. A resident representative of the United States Public Health Service has been assigned to Boston and has been of great assistance to the Department.

Health Districts.— Progress has been made in the better co-ordination of health services by the creation of the position of Assistant to the Commissioner to act as Director of Local Health Administration. With the addition of an Assistant District Health Officer and a sanitary officer, an outstanding development of the year has been the establishment of the Worcester Health District. This step will undoubtedly result in more effective co-ordination and further extension of State public health activities, bringing all Divisions of the Department into closer cooperation in health work with the population of the Worcester District. Enlarged office space and concentration of the headquarters of increased personnel will make prompt service more readily available to the area. Although the personnel are under the technical supervision of their respective Division Directors, for administrative purposes their activities are co-ordinated by the District Health Officer. It is anticipated that the Worcester Health District program will be the forerunner of other such local districts and will tend to improve public health practice throughout the State.

The present plan of organization of the Berkshire Health Unit will be discontinued at the end of the year as three of the major component organizations have announced their intention of withdrawing from the Unit at that time. As the budget contributed by the remaining organizations would not be sufficient to carry on with the present personnel and those remaining in the organization would not be content to accept reduced service when their contributions remain the same, the present health officer on January 1 will become a full-time District Health Officer and devote his time to all communities in the Berkshire District.

Approval of Laboratories.— In compliance with Chapter 344 of the Acts of 1939 certificates of approval have been issued to laboratories complying with the rules and regulations of the Department. Many laboratories have been informally approved for certain tests but the certificates will be withheld until a check has been made of the performance of all the tests for which approval is requested, as the name of each test will appear upon the certificate.

Mosquito Survey.— As mentioned elsewhere in this report, the final results of the survey conducted under the provisions of Chapter 14 of the Acts of 1939 have been tabulated and submitted in a report to the Legislature. As a result of the survey the Department has on file valuable information relative to breeding places and the types of mosquitoes capable of transmitting the virus of encephalitis, which will aid in directing mosquito control measures should the disease again appear in Massachusetts.

Camps.— This was the first full year of our activities under the provisions of Chapter 416 of the Acts of 1939 relative to the licensing of recreational, overnight and trailer camps. Very satisfactory co-operation has been received from the local boards of health in this matter as local communities throughout the State recognize that the control of such camps will definitely attract tourists and vacationists to the State. The Division of Sanitary Engineering has this year examined the water supply and sewage disposal facilities at 634 camps located in 166 municipalities over the State.

Milk.— During the year seven communities of the State have passed regulations requiring pasteurization or certification of all milk sold. Four additional communities have similar regulations which will become effective in the near future. Large quantities of pasteurized milk are also sold in communities where it is not required. Therefore, we estimate that almost 90 per cent of the milk sold in Massachusetts is now protected by pasteurization.

Arthritis.— Our study to determine the feasibility of a hospitalization program for arthritis patients has been continued for the third year. The average number of patients cared for under our contract with the Massachusetts General Hospital was 20 and the average length of hospitalization for each patient was 68 days. Of 108 patients cared for, 77 were discharged as improved, 20 as unchanged, 8 were patients previously treated during the year, and three died.

Services for Crippled Children.— The fourth year of the existence of this service shows no decline in interest but rather an increase in the number of children under active caie, who are receiving hospitalization, physiotherapy treatments and apparatus for correction. The physicians of the State have shown splendid co-operation in the support of our program. Children have been admitted to 24 hospitals throughout the State; 173 operations were performed, special treatments were given, and casts or braces supplied. Eleven clinic sessions have been held during the year in each of the ten clinic centers, and 4,500 physiotherapy treatments were given to patients for whom such treatment was prescribed at the clinics.

The first full year of reporting of deformities and other crippling conditions in infants, as directed by Chapter 326 of the Acts of 1939, shows a total of 199 such reports, including 150 orthopedic, 33 plastic, 5 Mongolian idiot, and 11 others.

A program for the care of children suffering from acute rheumatic fever has been formulated and it is hoped may be inaugurated during the coming year.

Postgraduate Education.— In co-operation with the Massachusetts Medical Society, the United States Public Health Service, and the Federal Children's Bureau, medical postgraduate extension courses, which are offered free to all registered physicians of the Commonwealth, have been conducted in various sections of the State. Courses in genitoinfectious disease control have also been made available. Two courses for prenatal clinic physicians were conducted in co-operation with the Harvard School of Public Health.

II. Communicable Diseases

None of the communicable diseases reached epidemic proportions during the year except in very localized areas. A total of approximately 84,000 cases was reported.

Prevalence of Certain Diseases

Anterior Poliomyelitis (Infantile Paralysis).— For the third consecutive year this disease has been at an unusually low level, only 45 cases having been reported.

Diphtheria.— This disease reached a new low level, with a total of 144 cases for the year.

Dysentery, Bacillary.— Although the 1940 incidence of this disease showed a decided decrease, sporadic cases have occurred in widely scattered communities over the State and small outbreaks have appeared in various institutions. The Sonne dysentery bacillus again appears to be the variety most frequently found.

Encephalitis, Infectious.— The number of cases caused by various etiological agents has been low, only 13 having been reported during the year. A careful check of each reported case of encephalitis, meningitis and poliomyelitis failed to disclose any which were due to the equine virus.

Gastroenteritis.— Although outbreaks of gastroenteritis showed a decrease, the appearance of the disease among newborn infants in the obstetrical departments of several hospitals caused some concern, and efforts are being made to put into effect more stringent precautions to prevent spread when a case occurs in a nursery.

Influenza.— Even though recent reports from other sections of the country suggest the prevalence of this disease, up to the present time we have no authentic indication that Massachusetts may expect any increased incidence.

Malaria.— Only 7 cases of this disease were reported during the year. In each case investigation showed that the disease was either contracted outside the State or was purposely induced to relieve symptoms of central nervous system syphilis.

Measles.— The number of cases reported, 21,698, is somewhat lower than in recent years, and the deaths from this disease have also greatly decreased in number, resulting in the lowest mortality rate and case fatality rate ever recorded.

Meningitis.— Meningococcic meningitis reached a new low level, only 47 cases being reported during the year. After an upward trend during the past few years, the incidence of meningitis due to the Pfeiffer bacillus again started downward and reached a new low level, with 11 cases being reported as compared with 19 in 1939.

Pneumonia.— Both cases and deaths have decreased, reaching the lowest point on record in a seven-year period. This may be due to the use of chemotherapy (sulfapyridine and later sulfathiazole) by which cases can now be treated favorably by drug alone or by a combination drug and serum therapy. During the year therapeutic serum has been made available for three additional types of pneumonia, so that at the present time serums are available for Types 1, 2, 4, 5, 7, 8, 9, 14 and 18, and for the remaining types if the patient has a positive blood or spinal fluid culture.

Scarlet Fever.— While the average incidence of this disease for the year was low, toward the end of the year there was indication of a slight increase, which may be a seasonal increase.

Septic Sore Throat.— The reporting of approximately 200 cases of septic sore throat cannot be considered an unusual incidence of this disease.

Smallpox.— Because of the strict enforcement of our compulsory vaccination law and the continued wholehearted co-operation of the laity in the matter of vaccination, Massachusetts has had no cases of smallpox for eight consecutive years.

Trichinosis.— The noticeable increase in this disease, 46 cases having been reported, indicates that we must be on guard to detect any laxity in properly cooking pork products.

Typhoid and Paratyphoid Fever.— Typhoid and paratyphoid fever as reported still remain in the vicinity of 100 cases and the slight increase this year may be attributed to an outbreak of thirteen cases caused by food prepared by a person not previously known to be a carrier. For the first time in many years, persons upon our typhoid carrier list have been responsible for cases of the disease, in spite of our continued efforts to impress upon carriers and members of their families the seriousness of their situation and the necessity of complete co-operation with the Department. Nineteen carriers were added to our list in 1940, making the total typhoid carrier list in the State 159.

Undulant Fever.— The year has shown an increase in cases of this disease. As our investigations show that most of these cases report the regular use of raw milk, I feel that we shall continue to have cases of undulant fever until there is State-wide pasteurization of our milk supplies.

Whooping Cough.— This disease remains about the same as has been reported in previous years, at a relatively low level.

Other Diseases.— I am glad to report that there have been no cases of psittacosis, rabies, Rocky Mountain spotted fever, or tularemia, our freedom from the latter diseases being the result of restricted importation of rabbits from possibly infected areas over the country.

Division of Tuberculosis

Our statistics continue to show a decrease in tuberculosis deaths to an all-time low level. Sanatorium treatment, with the increasing modern methods of surgery, have been largely responsible for this decrease. The accepted methods of case finding and the more frequent use of the X-ray have resulted in detecting cases in an early and favorable stage of disease. There is now no delay in admitting patients to the State sanatoria for prompt treatment of pulmonary tuberculosis, but at intervals over the year we have had waiting lists for cases of extrapulmonary tuberculosis and poliomyelitis at the Lakeville State Sanatorium. County and municipal sanatoria throughout the State report that their beds have been well filled, with occasional waiting lists.

The clinic work has been continued in the selected high school grades, in teachers colleges, and other institutions. "Reclassification Clinics," started last year, were held in 53 communities at the request of the local boards of health.

Division of Genitoinfectious Diseases

Public interest in the control of gonorrhea and syphilis appears to continue and to become even more intense with the added responsibilities incurred as a part of our National Defense program. In addition to our own program of genitoinfectious disease control, every effort is being made to co-operate with the United States Public Health Service and the military and naval authorities. Although in many sections of the country, more attention is given to the control of syphilis than to gonorrhea, the Massachusetts program gives equal emphasis to the control of both diseases, with the provision of adequate treatment facilities and case finding. The year has shown a decrease in the reports of gonorrhea and a slight increase in the reports of syphilis, but both diseases for the past two years show a general downward trend.

There was a marked decrease in the number of persons reported by name as having prematurely discontinued treatment or as having been in contact with infection. This illustrates the effectiveness of the clinic service throughout the State.

Laboratories

Antitoxin and Vaccine Laboratory.— The distribution of most of our products remained about the same as in recent years although the distribution of diphtheria antitoxin was about six per cent less and that of scarlet fever antitoxin dropped to a new low level, while the distribution of silver nitrate ampoules increased about 33 per cent.

Studies have been continued relative to diphtheria toxin production, immunization against scarlet fever by means of toxoid, and the problem of chill and thermal reactions following the injection of antipneumococcic serum. The possible co-operation of this laboratory with the American Red Cross in their project for banking blood from donors is being considered.

Wassermann Laboratory.— The year has again displayed a steady increase in the number of tests performed, the number of Hinton tests being about 25 per cent greater than last year. The serologic tests for syphilis required under the Selective Service Act are being performed at this laboratory and will probably add at least 50,000 tests a year to the usual work. In the comparatively few weeks since this program was started, over 8,000 tests have been made on members of the National Guard and over 9,600 tests in connection with the military training program.

The evaluation of laboratories to determine their efficiency in performing serologic tests for syphilis has been conducted by submitting specimens to those laboratories whose applications are still pending and checking from time to time the performance of those already approved.

Bacteriological Laboratory.— There was a decided increase in the total number of specimens received at this laboratory, the increase being in the number of specimens sent in for examination for the tubercle bacilli and for bacilli of the enteric diseases, while the demand for pneumococcus typing and diphtheria examination decreased. This laboratory still continues its work in training bacteriologists and technicians in pneumococcus typing, 34 persons having received such training during the year.

III. Hygiene

Division of Child Hygiene

The activities of this Division have continued principally in the following fields:

Maternal, Infant and Preschool Hygiene.—The monthly letters giving prenatal and postnatal information to mothers were sent out as formerly. New requests for such communications were received from over 8,400 prospective mothers and from approximately 9,164 mothers of newborn infants. The records of the deaths of premature infants revealed that the welcome decrease in such deaths is continuing. Observation centers for the care of prematures were established in Quincy, Holyoke, Worcester and Salem, where nursery supervisors from fourteen hospitals had an opportunity to study the care of premature infants. At the request of the State Department of Public Welfare, the Division of Child Hygiene is assisting in an advisory capacity in the revision of standards for licensing of maternity hospitals. Seven institutes for public health nurses were held during the year, with emphasis on the subject of "Health Supervision of the Preschool Child." Approximately 80 state demonstrations and conferences were held, and nearly 3,500 children received benefit therefrom.

School Hygiene.—A School Health Council has been formed, including representatives of the State Departments of Education and Public Health, to devise ways and means leading to increased co-operation between school and health authorities and where possible to act in an advisory capacity to communities and others seeking advice. The plan of lending audiometers to local school personnel for giving hearing tests to school children was continued. Vision tests were carried on in ten towns, including 31 schools and a total of 8,800 pupils. It is hoped that the Department may be able to supply vision testing kits to schools in the near future.

Public Health Nursing.— Sixty-four lectures were given by the nurses of the Division and eighteen group conferences were held for nurses in various parts of the State. Approximately 1,000 home visits were made by staff nurses following Well Child Conferences.

Nutrition.— In the field of nutrition increased interest and expansion of service have been stimulated due to the facilities being made available through the Massachusetts School Lunch Advisory Committee of the Federal Surplus Marketing Administration. The co-operation with health education groups, welfare groups, and this Department will effect an increase in the use of surplus food products and has already resulted in a definite program for the use of such products in school lunches. Visits were made to schools, affording consultation service to school lunchroom managers, and to the State Sanatoria for tuberculosis.

Dental Hygiene.— Special efforts were made this year in the interests of children's dentistry. The dental surveys inaugurated last year continued in eleven communities over the State. A series of ten institutes held in various sections of the State attracted an attendance of over 1,000, including 255 dentists. A number of general meetings were held, and two were restricted to dentists only and included demonstrations of practices in children's dentistry.

Parent Education.— In the fall a second conference was held for the group of Lay Leaders in Parent Education; special conferences were held in 32 communities concerning community projects in parent education.

Health Education.— The health education activities have again centered in four general fields: adult community health education, training of public health personnel, educational methods for staff members, and teacher training for health education in the schools. A successful program was carried on with high school pupils. The work was planned primarily for high school girls but as a number of requests were received for similar talks for boys this service was extended to high school boys and youth organizations, resulting in approximately 12,000 persons of high school age being reached in this program. Our Chief Supervisor of Health Education completed 79 pieces of new health educational material, including six new card-table sized exhibits and large exhibits on shellfish and on the mosquito survey. Our exhibits were displayed at meetings of the Massachusetts Medical Society, the Massachusetts State Nurses' Association, and the New England Hospital Association, and at the Boston Book Fair, the Eastern States Exposition, and the New England Drug and Health Show, as well as before smaller groups. As an economy measure, "The Commonhealth" was published only twice during the year.

Division of Adult Hygiene

Epidemiology and biometrics have demonstrated their value in revising and developing codes for cancer hospital records and have been a definite aid in our cancer control program. The Massachusetts codes are the first of their kind and the interest being shown in our system indicates that we have a desirable method for this type of program.

A study has been developed of cancer death records, aimed to measure the improvements in reporting and in the response of the public to the facilities for the care and treatment of cancer. Another study to evaluate social service in cancer clinics was inaugurated and will continue during the coming year. This will determine the relative case loads of the workers and the extent to which co-operating agencies in various communities are being contacted, and the number of cases reporting regularly to the clinic as well as the number neglecting their follow-up examinations.

In May a publication, entitled "Cancer: A Manual for Practitioners," compiled by a committee representing the Massachusetts Branch of the American Society for the Control of Cancer, the Massachusetts Medical Society, and the Massachusetts Department of Public Health, was distributed to every physician in the State.

IV. Environmental Control

Division of Sanitary Engineering

The year 1940 has been an extremely active one for this Division, as shown by the numerous additional demands for advice relative to water supply, sewage disposal, ice supplies, bathing beaches, shellfish, pollution of streams, and allied sanitary matters. The year's total of 2,482 requests for advice represents the greatest number of such requests on record and indicates the importance of sanitation in 1940 as compared with 1921 when only 226 requests for such service were received.

Rainfall.— The rainfall as recorded throughout the State was about normal but only immediately previous to the heavy general rains of November was there any concern about the low water situation, and unless there is excessive cold weather an average supply throughout the winter should prevail.

Pollution of Streams.— As mentioned elsewhere in this report, the Department through the Division of Sanitary Engineering has co-operated with the Federal Work Projects Administration in the preparation of reports on the pollution of the principal rivers of the State. Complaints have been made to the Department during the past year relative to pollution of the Westfield River, the Rumford River, the Charles River, the Mystic River, the French River, and certain smaller streams. These complaints, however, were no greater in number than in previous years and were due in large part to low water in the streams. Largely due to industrial processes carried on in the vicinity, it was necessary during part of the year to require chlorination of the water at one beach and to prevent bathing at another beach on the Charles River, and to admit additional quantities of water from Lake Miramichi into the Wading River at Attleboro in order to prevent a nuisance in the river. A special investigation was started in the latter part of the year, with experiments to determine a satisfactory means of treatment of a new kind of waste from a paper mill discharging into the Housatonic River.

Sewage Disposal.— New sewage treatment works were put into operation during the year at Springfield, Amherst, Greenfield and Mansfield. Progress in varying degrees is being made toward new or additional sewerage works at East Longmeadow, Longmeadow, West Springfield, Agawam, Chicopee, Northampton, Ludlow, Gardner, Southbridge, Fall River, Plymouth, Saugus, Belchertown, Russell, the Monson State Hospital and the Grafton State Hospital. The Division of Sanitary Engineering has examined plans submitted by the Work Projects Administration relative to the construction of sewerage works in 53 municipalities. The new sewage disposal works at Fort Devens and Camp Edwards which have been under construction during the latter part of the year should be in use early in 1941.

Shellfish.— Owing to the increasing popularity of shellfish as food, constant supervision has been carried out so that restrictions were placed on the taking of shellfish from five contaminated areas on the North and South shores. Five moderately polluted areas were approved temporarily for the taking of shellfish for purification purposes. The closing of the purification plant at Scituate is further evidence of the need of strict supervision of the industry and enforcement of the laws relative to shellfish. The shellfish purification plant at Newburyport has been in operation throughout the year and has been checked at regular intervals by members of the staff of the Lawrence Experiment Station.

Cross Connections.— The importance of investigating piping conditions in industrial plants to determine possible cross connections between water supplies for fire and industrial purposes and supplies for drinking purposes has warranted the employment of an engineering assistant whose full time is devoted to such inspections. In 1,103 plants examined, 865 cross connections were detected, of which 300 were found to be in a condition which did not protect the drinking water supplies. In all cases these conditions were called to the attention of the owners.

Engineering Districts.— The large volume of work necessitated the re-establishment of the boundaries of the sanitary engineering districts and the establishment of an additional district. The areas of the five districts as now constituted will be found in the complete report of the Division of Sanitary Engineering.

Water and Sewage Laboratories

The popular demand for the services of our Water and Sewage Laboratories is indicated by requests for 7,230 chemical analyses and 2,208 microscopical examinations in connection with water supplies, sewage disposal and pollution of streams. Special work was done on corrosive correction treatment of water supplies of several municipalities and state institutions. Examinations of sediment in water, of sand from the shores of Quincy Bay for the determination of mineral and other oils, of samples of sewage and water for the presence of gasoline therein, of wax crayons for lead content, of a red water condition and the optimum dosage of lime necessary to correct it, and of samples of water from various sources to determine the mineral content are representative of the varied activities of these laboratories. A special study was made of the effect of copper sulphate on Hydranth Craspedacusta (fresh water jellyfish), the appearance of which in one of the water supplies created an unusual situation.

Lawrence Experiment Station.— This laboratory continues its well-known and numerous studies and experiments. During the year 18,230 bacterial and about 2,500 chemical analyses were made of industrial wastes, sand, shellfish, etc. In addition, about 2,000 exhaustive and varied experiments and tests have been carried on, the interesting details of which are given in the complete report of the Division of Sanitary Engineering.

Division of Food and Drugs

In addition to the regular activities of this Division which resulted in over 16,500 chemical and bacteriological examinations of food, milk and drugs, considerable work has been done on the Hendrey method for the determination of soybean meal in sausages. The use of this product in excess of 2 per cent is illegal, and by the Hendrey method the Division was successful in obtaining convictions in court, in some instances the quantity of soybean meal found being as high as 12 per cent.

On account of conditions abroad, which prevent the entrance of olive oil from the southern countries of Europe, increasing difficulty is being encountered relative to an adulterated product being sold as olive oil but consisting of cottonseed oil with a small amount of rancid olive oil. The excellent co-operation of the United States Food and Drug Administration and the Massachusetts Division of Standards has resulted in convictions for the sale of this product.

A great deal of research has been done during the year on the quantitative determination of lead in vinegar, on the bacterial count of goat milk, and for the detection of sodium alginate in dairy products.

Toward the end of the year, with the aid of Federal funds, plans were formulated for a study of the sale of food and drugs alleged to be of a definite vitamin potency. This project will be carried on at the Westfield Laboratory of the Division. Although some work has been done on this vitamin problem by the Federal Food and Drug Administration, there has been practically none carried on by individual states.

V. Regulations

Rules and regulations have been promulgated by the Department of Public Health relative to:

Diseases dangerous to the public health
Approved Aug. 9, 1938
Revised Oct. 11, 1938
Revised Feb. 14, 1939

Control of gonorrhea and syphilis
Approved Aug. 9, 1938
Revised Aug. 8, 1939
Revised Nov. 6, 1940

Conveyance of bodies dead of any disease dangerous to the public health
Approved Aug. 9, 1938
Revised Feb. 14, 1939

Funerals of persons dead of any disease dangerous to the public health
Approved Aug. 9, 1938

Cancer clinics
Approved Jan. 15, 1935

Tuberculosis hospitals
Approved May 10, 1938

Tuberculosis dispensaries
Approved May 10, 1938

Approved prophylactic remedy for use in the eyes of infants at birth
Approved May 12, 1936

Provision of treatment for persons suffering from gonorrhea and syphilis who are unable to pay for private medical care
Approved Aug. 10, 1937

Manufacture and bottling of carbonated nonalcoholic beverages, soda water, mineral and spring water
Approved April 7, 1936

Approval of contracts for the production and distribution of certified milk
Approved Oct. 14, 1936

Establishments for the pasteurization of milk
Approved Feb. 12, 1935

Operation of plants for the purification of shellfish
Approved April 7, 1936
Amended Oct. 10, 1938

Business of slaughtering and meat inspection
Approved Dec. 10, 1935

Purity and quality of food
Approved Feb. 9, 1937

Hams, pork butts and sausage containing pork products intended to be eaten without cooking
Approved Feb. 12, 1924

Business of cold storage

Approved Oct. 10, 1933

Sale of cold storage eggs

Approved July 11, 1922

Bakeries and bakery products

Approved Feb. 14, 1933

Tag to be attached to each article of bedding and each article of upholstered furniture

Approved Nov. 12, 1935

Sterilization of feathers, down and secondhand material intended for use in the manufacture of articles of bedding and upholstered furniture

Approved Nov. 12, 1935

Frozen desserts and ice cream mix

Approved Sept. 11, 1934

Treatment of persons exposed to rabies

Approved Aug. 10, 1937

Payment for certain laboratory tests on specimens from cases of pneumonia

Approved Nov. 11, 1938

Distribution of biologic products

Approved April 9, 1935
Amended May 14, 1940

Cross connections between public water supplies and fire and industrial water supplies

Approved Feb. 9, 1937

Rules and regulations for protecting the drainage areas and sources of water supply in cities and towns and fire and water districts and water companies.

Use of a common drinking cup

Amended Mar. 22, 1916

Providing of a common towel

Amended Mar. 22, 1916

Use of the common drinking cup and common towel in factories, workshops, manufacturing, mechanical and mercantile establishments

Dispensary license

Approved May 10, 1938

Jails, houses of correction, prisons and reformatories

Approved July 6, 1905

Lodging houses

Approved July 6, 1905

Cremation

Adopted Dec. 5, 1907
Amended Oct. 29, 1918

Sale of rabbits intended for food purposes

Approved May 14, 1929

Approval of bacteriological and serological laboratories
Approved Sept. 12, 1939

Use of blood or other tissues for purposes of transfusion
Approved Mar. 14, 1939

VI. Personnel

There have been two changes in the membership of the Public Health Council during the year. On May 1, 1940, Dr. R. Nelson Hatt of Springfield was appointed to succeed Dr. Charles F. Lynch, and Mr. Gordon Hutchins, who had served the Department as a member of the Public Health Council from 1926 to 1937, was appointed to succeed Dr. George D. Dalton.

On October 1 Dr. John J. Poutas was promoted from the position of District Health Officer to the newly created position of Assistant to the Commissioner of Public Health. In this capacity he will act as the direct representative of the Commissioner in the various health districts and units over the State. At the same time Dr. Vlado A. Getting was appointed as Assistant District Health Officer in the Worcester District.

Dr. Ernest M. Morris, who has served as District Health Officer in various sections of the State during the past few years, resigned at the close of the year to become Health Commissioner of the city of Newton. On October 14 Dr. Charles E. Gill returned to the Department as District Health Officer in the South Connecticut Valley District.

It is with regret that I report the death on August 5 of Dr. Peter Ferrini, Assistant Superintendent of the Lakeville State Sanatorium. Dr. Claire W. Twinam, who has been conducting special tuberculosis studies for the Department during the past four years, was appointed Assistant Superintendent to succeed Dr. Ferrini.

I also report with regret the death of Thomas L. Boland, Food Inspector, on March 31. Mr. Boland served the Department in various positions since 1923.

Miss Eleanor E. Kelly, who served as Supervisor of Social Service for seven years, resigned on January 15. There was delay in finding an adequately trained person to fill this position, but on October 1 the Department was able to secure the services of Miss Helen J. Almy.

On August 31 Dr. Lila O. Burbank resigned as Public Health Education Worker in the Division of Adult Hygiene. For several years the Department has had the benefit of Dr. Burbank's skill in arranging its radio programs. Miss Frances A. Macdonald was promoted from the position of Junior Epidemiologist to that of Biometrician in the Division of Adult Hygiene.

Dr. Hugo V. Ascolillo, formerly Assistant Physician at the Westfield State Sanatorium, was appointed as Child Welfare Physician in the Division of Tuberculosis to aid in the Reclassification Clinics. Miss Katherine F. Mullane, Supervising Tuberculosis Field Nurse, resigned on August 4 to accept another position.

The death of Dr. Hanz Zinsser, Professor of Bacteriology and Immunology at Harvard Medical School, means a loss to the Department, which had enjoyed the benefit of his advice and assistance on various matters of public health significance.

VII. Organization

The organization of the Department is as follows:

Commissioner of Public Health 1
Public Health Council 6
Division of Administration:
Secretary (1), Clerks and Stenographers (13)
(Social Security): Assistant to Commissioner of Public Health (1), Assistant Director of Public Health Administration (1), Supervisor of Clinics for Crippled Children (1), Assistant District Health Officer (1), Public Health Nursing Supervisors (10), Public Health Social Work Supervisors (5), Bracemaker (1), Dental Hygienist (1), Clerks and Stenographers (8) 43

Division of Adult Hygiene:
Herbert L. Lombard, M.D., Director.
Epidemiologists (3), Social Workers (3), Public Health Education Workers (2), Clerks and Stenographers (15)
(Social Security): Assistant Director (1), Biometrician (1), Statistician (1), Public Health Education Workers (6), Social Worker (1), Clerks and Stenographers (6) 40

Division of Biologic Laboratories:
Elliott S. Robinson, M.D., Director.
Assistant Director (1), Chemists and Bacteriologists (11), Laboratory Assistants (3), Laboratory Helpers (8), Stable Foreman (1), Laborers (15), Janitors (2), Clerks and Stenographers (4)
(Social Security): Assistant Director (1), Chemist and Bacteriologist (2), Laboratory Helper (1), Laborers (2), Clerk and Stenographer (1)

Wassermann Laboratory:
Chief of Laboratory (1), Bacteriologist (1), Laboratory Technicians (2), Laboratory Helpers (6), Clerks and Stenographers (4)
(Social Security): Bacteriologists (2), Laboratory Assistant (1), Laboratory Helpers (8), Clerks and Stenographers (7) . . 85

Division of Child Hygiene:
M. Luise Diez, M.D., Director.
Child Welfare Physicians (2), Public Health Dental Hygienist (1), Public Health Nutrition Workers (4), Public Health Education Workers (2), Public Health Nursing Supervisors (8), Clerks and Stenographers (15)
(Social Security): Assistant Director (1), Child Welfare Physicians (2), Public Health Dental Supervisor (1), Public Health Nutrition Workers (5), Public Health Nursing Supervisors (4), Teacher Training Co-ordinators (2), Head of Research Learning Project (1), Research Learning Consultant (1), Infant Welfare Field Nurses (2), Public Health Social Work Supervisor (1), Laboratory Technician (1), Clerks and Stenographers (12) 66

Division of Communicable Diseases:
Roy F. Feemster, M.D., Director.
Assistant Director (1), District Health Officers (8), Epidemiologists (2), Clerks and Stenographers (9)
(Social Security): Epidemiologists (3), Health District Sanitary Officer (1), Public Health Nutrition Worker (1), Laboratory Technician (1), Laboratory Helper (1), Clerks and Stenographers (3)

(Diagnostic Laboratory):
Chief of Laboratory (1), Bacteriologists (4), Laboratory Assistant (1), Laboratory Helper (1), Laborers (2), Clerk and Stenographer (1)
(Social Security): Bacteriologists (3), Clerk and Stenographer (1) . 45

Division of Food and Drugs:
Hermann C. Lythgoe, Director.
Chief of Laboratory (1), Chemists and Bacteriologists (5), Inspectors (13), Laboratory Helpers (3), Clerks and Stenographers (7)
(Social Security): Inspector (1), Chemist and Bacteriologist (2), Laboratory Helper (1), Clerks and Stenographers (2) . . . 36

Division of Genitoinfectious Diseases:
Nels A. Nelson, M.D., Director.
Epidemiologist (1), Clerks and Stenographers (6)
(Social Security): Epidemiologist (1), Public Health Nursing Supervisors (3), Clerks and Stenographers (4) 16

Division of Sanitary Engineering:
Arthur D. Weston, Director and Chief Sanitary Engineer.
Engineers and Engineering Assistants (17), Food Inspector (1), Clerks and Stenographers (12)
(Social Security): Engineering Assistants (10), Clerks and Stenographers (5)

(Water and Sewage Laboratories):
Chiefs of Laboratory (2), Chemists and Bacteriologists (10), Laboratory Assistant (1), Mechanical Handyman (1), Laborer (1), Watchman (1), Clerks and Stenographers (4)
(Social Security): Chemists and Bacteriologist (4), Laboratory Assistant (1), Laboratory Helpers (2) 73

Division of Tuberculosis:
Alton S. Pope, M.D., Director and Deputy Commissioner.
Assistant Directors (2), Superintendent of Sanatoria Construction (1), Inspector of Settlements and Support Claims (1), Social Workers (2), Field Nurse (1), Clerks and Stenographers (11)
(Social Security): Child Welfare Physician (1), Occupational Hygiene Physician (1), Bacteriologist (1), Laboratory Technicians (2), Social Workers (2), Senior Engineering Aid (1), Chemists (2), Clerks and Stenographers (9)

(Tuberculosis Clinics):
Supervisor of Tuberculosis Clinics (1), Child Welfare Physicians (2), Field Nurses (4), Public Health Nutrition Workers (2), X-ray Clinic Field Agents (2), Clerks and Stenographers (6) . . . 55

466

VIII. Publications

The following articles by members of the staff have been published:

Division of Administration

The Relation of Mosquitoes to Equine Encephalomyelitis in Massachusetts
Paul J. Jakmauh, M.D.
Proceedings of the Twenty-seventh Annual Meeting of the New Jersey Mosquito Extermination Association: 12–18, 1940.

Division of Adult Hygiene

The Massachusetts Cancer Program (questions and answers)
Herbert L. Lombard, M.D.
New England Journal of Medicine, 222: 730–731, April 25, 1940.

Cutaneous Carcinoma Diagnosed Clinically without Biopsy: Results of Treatment in a Consecutive Series
Shields Warren, M.D., Channing C. Simmons, M.D., and Stanley L. Rea, M.D.
Journal of the American Medical Association, 114: 1619–1622, April 27, 1940.

Radiation Reaction in the Lung
Shields Warren, M.D. and Jack Spencer, M.D.
American Journal of Roentgenology and Radium Therapy, 43: 682–701, May, 1940.

Evaluation of Cancer Control Methodology
Eleanor J. Macdonald, A.B. and Frances A. Macdonald, A.B.
American Journal of Public Health, 30: 483–492, May, 1940.

Radiation Pneumonitis
Shields Warren, M.D. and Olive Gates, M.D.
Archives of Pathology, 30: 440–460, July, 1940.

Relation of "Chronic Mastitis" to Carcinoma of Breast
Shields Warren, M.D.
Surgery, Gynecology and Obstetrics, 71: 257–273, September, 1940.

If You Have Cancer in Massachusetts
Herbert L. Lombard, M.D.
National Bulletin of the American Society for the Control of Cancer, 22: 3–4, October, 1940.

Treatment of Leukemia by Radioactive Phosphorus
Shields Warren, M.D.
New England Journal of Medicine, 223: 751–754, November 7, 1940.

Cancer of the Skin in Relation to Multiple Malignant Growths
Shields Warren, M.D. and Olive Gates, M.D.
Journal of the American Medical Association, 115: 1705–1707, November 16, 1940.

Division of Biologic Laboratories

Studies on the Molecular Weight of Diphtheria Toxin, Antitoxin, and Their Reaction Products
A. M. Pappenheimer, Jr., Ph.D., H. P. Lundgren and J. W. Williams
Journal of Experimental Medicine, 71: 247–262, February, 1940.

Anti-Egg Albumin Antibody in the Horse
A. M. Pappenheimer, Jr., Ph.D.
Journal of Experimental Medicine, 71: 263–269, February, 1940.

Choline, Pantothenic Acid, and Nicotinic Acid as Essential Growth Factors for Pneumococcus
Leo Rane, Ph.D., and Yellapragada Subbarow
Journal of Biological Chemistry, 134: 455, June, 1940.

Nutritional Requirements of the Pneumococcus I. Growth Factors for Types I, II, V, VII and VIII
Leo Rane, Ph.D., and Y. Subbarow
Journal of Bacteriology, 40: 695, November, 1940.

Chemotherapy and Serum Therapy of Pneumonia
Frederick T. Lord, M.D., Elliott S. Robinson, M.D., and Roderick Heffron, M.D.
The Commonwealth Fund, 1940.

Division of Child Hygiene

The School Lunch in Rural and Small-Town Schools — A Symposium
Summary by Mary Spalding
Journal of Home Economics, 32: 91–92, February, 1940.

What High Schoolers Think about Teeth
Florence Hopkins, D.M.D.
Proceedings of the Dental Centenary Celebration, March, 1940.

The Care of Premature Infants; State-wide Program in Massachusetts
Ann W. Dinegan, R.N., and Madelen P. Pollock, R.N.
American Journal of Nursing, 40: 637–640, June, 1940.

Educational Principles Underlying Dental Health Education
Jean V. Latimer
The Journal of Health and Physical Education, 11: 541, 572, 573, November, 1940.

Teachers Study the Child's Health Needs
Jean V. Latimer
Public Health Nursing, 32: 668–670, November, 1940.

Educational Principles Underlying Dental Health Education
Jean V. Latimer
Bulletin of the Nassau County Dental Society, 15: 6–9, November, 1940.

Has It Been Proved that Sugar Is a Significant Factor in Dental Caries?
Florence B. Hopkins, M.D., D.M.D.
Journal of the American Dental Association, 27: 1801–1803, November, 1940.

Massachusetts Vision Test — An Improved Method of Testing Eyes of School Children
Albert E. Sloane, M.D.
Archives of Ophthalmology, 24: 924–939, November, 1940.

Teachers in the Public Health Program
Jean V. Latimer
The Massachusetts Teacher, 20: 4–5, December, 1940.

The Integration of Nutrition Instruction in the Secondary Schools
Jean V. Latimer
The Journal of School Health, 10: 294–299, December, 1940.

Division of Communicable Diseases

A Study of Birds and Mosquitoes as Hosts for the Virus of Eastern Equine Encephalomyelitis
William A. Davis, M.D.
American Journal of Hygiene, Sect. C, 32: 45–59, September, 1940.
Some Epidemiological Considerations of Diphtheria
Vlado A. Getting, M.D.
New England Journal of Medicine, 223: 717–721, October 31, 1940.

Division of Food and Drugs

Composition of Goat Milk of Known Purity
Hermann C. Lythgoe
Journal of Dairy Science, 23: 1097–1108, November, 1940.

Division of Genitoinfectious Diseases

The Epidemiology of Gonococcal Infection
N. A. Nelson, M.D.
American Association for the Advancement of Science, Publication No. 11: 57–63, 1940.
Why Don't We Stamp Out Gonorrhea?
N. A. Nelson, M.D.
Venereal Disease Information, 21: 313–319, October, 1940.

Division of Sanitary Engineering

Cross Connections and the Plumbing Testing Laboratory in the New Bedford Vocational School
E. J. Sullivan
New England Water Works Association Journal: 179–185, June, 1940.
Siphonable Plumbing Fixtures in Common Use at State Institutions
E. J. Sullivan
Progress, II, No. 12: 11–12, August, 1940.
Pollution of Boston Harbor
Arthur D. Weston and Gail P. Edwards
Proceedings, American Society of Civil Engineers, Transactions Number: 973–1009, October, 1940.
Mosquito Control Accomplishments in Massachusetts in 1939
Edward Wright
Proceedings of the Twenty-seventh Annual Meeting of the New Jersey Mosquito Extermination Association, 1940.

Division of Tuberculosis

The Significance of the Radiation Reaction in Carcinoma of the Cervix Uteri
Shields Warren, M.D., J. V. Meigs, M.D., F.A.C.S., Alvin O. Severance, M.D., and Henry L. Jaffe, M.D.
Surgery, Gynecology and Obstetrics, 69: 645–647, November, 1939.
Development of Tuberculosis in Infected Children
Alton S. Pope, M.D., F.A.P.H.A., Philip E. Sartwell, M.D., and David Zacks, M.D.
The American Journal of Public Health, 29: 1318–1325, December, 1939.
Uremia Following X-ray Therapy in Leukemia
Dudley Merrill, M.D.
New England Journal of Medicine, 222: 94–97, January 18, 1940.
Teratoma of the Spermatic Cord; Case Report with a Consideration of the Prolan Test
Roger C. Graves, M.D., Charles J. E. Kickham, M.D., and Weston T. Buddington, M.D.
American Journal of Surgery, 47: 116–120, January, 1940.

Carcinoma of the Scrotum
Roger C. Graves, M.D., and Spencer Flo, M.D.
Journal of Urology, 43: 309–332, February, 1940.

Ureteral and Renal Complications of Carcinoma of Cervix; Their Classification and Management
H. L. Jaffe, M.D., J. V. Meigs, M.D., R. C. Graves, M.D., and C. J. E. Kickham, M.D.
Surgery, Gynecology and Obstetrics, 70: 178–184, February, 1940.

Tuberculosis Among Massachusetts School Children; a Report on the Massachusetts Ten-Year Program. Part I. The Incidence of Infection
E. P. Hutchinson and Alton S. Pope, M.D.
The American Journal of Hygiene, Sec. A, 31: 62–77, March, 1940.

Metastatic Neoplasms; Clinical and Roentgenological Study of Involvement of Skeleton and Lungs
J. W. Turner, M.D., and H. L. Jaffe, M.D.
American Journal of Roentgenology and Radium Therapy, 43: 479–492, April, 1940.

The Antemortem Recognition of Pulmonary Embolism
Allen S. Johnson, M.D.
New England Journal of Medicine, 222: 793–796, May 9, 1940.

Prognostic Factors in Carcinoma of the Breast
Grantley W. Taylor, M.D., and Norman H. Bruce, M.D.
New England Journal of Medicine, 222: 790–792, May 9, 1940.

The Etiology of Idiopathic Pneumothorax
Heinz J. Lorge, M.D.
The American Journal of the Medical Sciences, 199: 635–641, May, 1940.

Endometrial Sarcoma
Robert Fienberg, M.D.
Archives of Pathology, 29: 800–812, June, 1940.

A Large Adenofibroma of the Breast; Report of Case
Frederick S. Hopkins, M.D.
New England Journal of Medicine, 223: 53–54, July 11, 1940.

Spontaneous Pneumothorax
Paul Dufault, M.D.
Notes on Tuberculosis — issued by the Provincial Committee for the Prevention of Tuberculosis, Quebec, Canada, August, 1940.

The Clinical Management of Breast Tumors
Grantley W. Taylor, M.D.
New England Journal of Medicine, 223: 538–539, October 3, 1940.

A. T.B.'s Progress — The Story of Norman Bethune
Gabriel Nadeau, M.D.
Bulletin of the History of Medicine, 8: 1135–1171, October, 1940.

Tuberculous Bronchial Polyp
Oscar Feinsilver, M.D.
The American Review of Tuberculosis, 42: 540–542, October, 1940.

Tuberculosis of the Greater Trochanter and Trochanteric Bursae
Joseph D. Wassersug, M.D.
The Journal of Bone and Joint Surgery, October, 1940.

The Late Manifestations of Pyelonephritis
A. Reynolds Crane, M.D.
Worcester District Medical News, November, 1940.

Thoracoplasty Following Pneumothorax — Dangers and Results
Isadore L. Cutler, M.D.
The American Review of Tuberculosis, 42: 640–643, November, 1940.

Urological Complications of Carcinoma of the Cervix
James A. Seaman, M.D.
Urologic and Cutaneous Review, November, 1940.

Lower Urological Tract Infection and Low Back Pain
James A. Seaman, M.D.
Transactions of New England Urological Association, 1940.

IX. Legislation

The Department is submitting the following proposed legislation:

1. An Act Increasing the Compensation of Members of the Public Health Council — (amending Section 3 of Chapter 17 of the General Laws). — Inasmuch as the members of the Public Health Council are outstanding professional men, with many private obligations, and since their duties as members of the Council do to a considerable degree interfere with their other duties, the Department is recommending that their compensation be more nearly comparable with the value of their services to the Commonwealth.

2. An Act Requiring the Clerk or Registrar of Each City or Town to Give to Persons Who File Notice of Intention of Marriage Suitable Information Concerning Gonorrhea and Syphilis — There is a great deal of annoying confusion as a result of the fact that legislation relative to premarital blood tests for syphilis as enacted in twenty states varies widely in scope and detail. This very confusion is excellent evidence that public health and medical and legislative opinion has by no means settled upon what should constitute sound procedure. Furthermore, many technical difficulties with relation to proper interpretation of blood tests have arisen.

This Department believes that so far as conditions in this State are concerned it would be much sounder to proceed as we have in the past with a program which places its greatest emphasis on freely available treatment and intensive public education. This bill aims to provide for the education concerning syphilis and gonorrhea of all candidates for marriage, as opposed to compulsory premarital blood testing which we believe to be unsound.

3. An Act Authorizing the State Department of Public Health to Require Certain Improvements Relative to Water Supply Including the Establishment of Proper Treatment Works by Cities, Towns and Water Companies — Although Chapter 340 of the Acts of 1937 amended Section 17 of Chapter 111 of the General Laws to require after a public hearing a city or town or water company to make such improvements relative to any existing treatment works as in its judgment may be necessary for the protection of the public health, this provision is not sufficient protection to the public health and the Department should be authorized to order improvements in the water supply as well as in the water treatment works.

4. An Act to Further Prevent Pollution of the Charles River — Investigations made during the summers of 1939 and 1940 by the Department of Public Health show that certain manufacturing wastes which are discharged into the Charles River result in large growths of bacteria characteristic of pollution, thus jeopardizing the public health of those using certain bathing beaches. In order for the Department of Public Health to prevent this condition it is necessary that Section 175 of Chapter 111 of the General Laws be amended since the mandatory powers given the Department in connection with the Charles River are not as stringent as those for some other streams in the Commonwealth.

5. An Act Authorizing the State Department of Public Health to Regulate Pollution and Contamination of Inland and Tidal Waters — This proposed bill is substantially in accordance with the recommendation of the special commission, authorized under the provisions of Chapter 11 of the Resolves of 1935, to study and investigate public health laws and policies, which recommended — "that the Department be given the power to make rules and regulations relative to the pollution of any stream in the Commonwealth, regardless of its use for water supply or other purposes," and that "such legislation should empower the Department to order the installation of works for the treatment of sewage and industrial wastes where necessary."

6. An Act Conferring upon the State Department of Public Health the Power to Order the Installation, Maintenance and Operation of Filter Beds or Other Works for the Treatment, Purification and Disposal of Sewage of Cities and Towns — Under the present law the Department of Public Health has no authority to order the installation of works for the treatment, purification and disposal of the sewage of a city or town. Consequently certain of our inland and tidal waters are grossly polluted. If the Department is to bring about improved conditions it is necessary that it have the authority requested in the bill herein referred to.

7. An Act Relative to Borrowing by Cities and Towns Outside the Debt Limit for the Purpose of Obtaining Additional Sources of Water Supply — Under present conditions Section 8 of Chapter 44 of the General Laws makes no proper provision for the borrowing of money for additional sources of water supply and makes no provision for financing additional sources of water supply or original pumping station equipment. The proposed act would make this provision and would prevent such controversies as recently occurred in connection with the financing of the water supply of the town of Dracut.

8. An Act Relative to the Development and Use by Cities and Towns of Sources of Water Supply Within Their Own Limits — This act is to straighten out certain inconsistencies contained in Chapter 40 of the General Laws as amended by Chapter 372 of the Acts of 1938 and provides that "any town may vote to authorize its board of selectmen to act as water commissioners with all the powers and duties of such commissioners until water commissioners shall be elected . . ." and that "a town which has so voted may at an annual town meeting, or at a special town meeting called for the purpose and held at least sixty days before the next annual town meeting, vote that at such next annual town meeting water commissioners shall be elected."

This amendment is drafted at the suggestion of the Director of the Division of Accounts, Department of Corporations and Taxation.

9. An Act Relative to the Licensing of Establishments for the Pasteurization of Milk — The statute permits the Department of Public Health by regulation to legalize the pasteurization of milk by the so-called high temperature, short-time method. In the states of Connecticut and New York, except New York City, plants operating this type of pasteurizer are licensed by the state authorities. The apparatus is extremely complex and in many instances will be set up in communities which do not have the funds available to employ inspectors capable of making the necessary studies of the apparatus prior to licensing its operation. The inspectors in many of the cities are fully qualified to do this work but the plants supplying these cities with pasteurized milk are frequently located in towns not having adequate milk inspection. The Department therefore recommends that if high temperature, short-time pasteurization is legalized by departmental regulations, the licensing of the plants be carried on by the Department and not by the board of health of the town where the plant is located.

10. An Act Relative to the Sale of Barbituric Acid, Its Derivatives, and Certain Other Sedatives—It has come to the attention of the Department that the almost unrestricted sale of certain sedatives has been responsible for sickness and in some instances for death. Material of this character is altogether too potent to be used indiscriminately for self-medication without first obtaining the advice of a physician. It is therefore recommended that the sale of this material be limited to sales upon prescription.

11. An Act Further Regulating the Manufacture, Bottling and Sale of Certain Nonalcoholic Beverages — There is a technical error in the penalty clause pertaining to the operation of carbonated beverage and spring water bottling plants. In the penalty clause the reference to the regulation is to section 10D. Under that section, however, regulations are not made and therefore there is no penalty for violating the regulations. The regulations are made under the provisions of section 10E of chapter 94 of the General Laws, and it is therefore recommended that the letter "D" in the penalty clause be changed to the letter "E" in order to correct what is presumably an error.

12. An Act Relative to the Sale within the Commonwealth of Articles of Bedding and Upholstered Furniture Manufactured without the Commonwealth — The Supreme Court has handed down an opinion holding that this section in its present form is unconstitutional. Under these circumstances, the Department recommends the repeal of the section.

13. An Act Relative to the Sale of Sewage-Polluted Shellfish — Section 194A of Chapter 94 of the General Laws relative to the sale or delivery of adulterated shellfish was inserted by Chapter 375 of the Acts of 1931 over the protest of the Department. The essence of this section is that the defendant can maintain a defense if he shows, by a witness or otherwise, that the shellfish were taken from clean areas or to have passed an approved shellfish treatment plant. An unscrupulous

dealer or group of dealers can enter such a defense regardless of the amount of sewage pollution found in the shellfish, and, in almost all cases where this act has been used, the result has been to defeat the efforts of the Department to keep sewage-polluted shellfish out of the markets. The existing act makes it practically safe to sell sewage-polluted shellfish as food.

14. An Act Making Various Changes in the Laws Relating to Foods and Drugs in Order that Such Law will be More Nearly in Conformity with the Federal Food, Drug, and Cosmetic Act insofar as It Pertains to Foods and Drugs — The changes in the United States Food and Drug Law are now in effect. A number of states have adopted the so-called Uniform Food, Drug, and Cosmetic Law recommended by the National Association of Dairy and Food Commissioners.

Two years ago this Department recommended a change in the law, which was referred to Next General Court, apparently to some extent because there was legislation in Congress deferring the effective date of the operation of the new United States Law. The present suggested bill, while similar to the draft submitted two years ago, omits certain provisions which are believed not essential for this State to adopt as they pertain to articles which are for practical purposes articles which will find their way into interstate commerce and hence will be under the supervision of the United States authorities. For the same reason nothing in this bill applies to cosmetics.

X. Financial Statement

Federal Grants from the United States Public Health Service and Children's Bureau

The allotments for public health work for the Federal fiscal year from July 1, 1940 to June 30, 1941 are as follows:

Treasury Department, United States Public Health Service		
Division of Administration	$16,725.00	
Division of Adult Hygiene	39,005.00	
Antitoxin and Vaccine Laboratory	16,240.00	
Pneumonia Control Project	12,127.00	
Division of Communicable Diseases	29,830.00	
Investigation and Control of Encephalitis	1,150.00	
Division of Food and Drugs	14,260.00	
Division of Occupational Hygiene	15,305.00	
Division of Sanitary Engineering	50,443.38	
Division of Tuberculosis	26,285.00	
Barnstable County Health Unit	3,180.00	
Berkshire Health District	4,770.00	
Nashoba Associated Boards of Health	7,909.00	
North Connecticut Valley District	8,945.00	
Worcester Health District	12,130.00	
Maternal and Child Hygiene	17,105.12	
Postgraduate Program	9,875.00	
Training Personnel	27,593.00	
Vitamin Assays	5,185.00	
Total — Public Health Work		$318,062.50
Treasury Department, Venereal Disease Control		
Postgraduate Program	$3,000.00	
Training Personnel	155.00	
Division of Genitoinfectious Diseases	65,606.73	
Wassermann Laboratory	102,765.00	
Laboratory Service — City of Boston	3,300.00	
Subsidy to Harvard School of Public Health for Instruction in Control of Gonorrhea and Syphilis	9,520.00	
Total — Venereal Disease Control		184,346.73
Department of Labor, Children's Bureau		
Crippled Children's Services A Account		87,925.49
Crippled Children's Services B Account		35,110.31
Maternal and Child Health Services A Account		112,243.49
Maternal and Child Health Services B Account		16,802.61
Grand Total — Federal Funds		$754,491.13*

* Includes balances of previous year.

Department of Public Health

Appropriations and Expenditures for Year Ended November 30, 1940

	Appropriation and Amounts Brought Forward	Expenditures to Nov. 30, 1940
Division of Administration	$37,783.54	$35,282.90
Division of Adult Hygiene	95,653.95	88,343.03
Division of Child Hygiene	86,061.50	78,704.68
Division of Communicable Diseases	92,777.39	89,145.33
Division of Genitoinfectious Diseases	315,826.13	255,433.08
Division of Food and Drugs	77,411.31	73,742.81
Administration of Shellfish Law	3,050.52	2,744.86
Division of Biologic Laboratories:		
Antitoxin and Vaccine	116,328.50	110,493.38
Wassermann Laboratory	25,972.98	25,041.92
Division of Water Supply and Sewage Disposal	155,219.00	149,996.36
Division of Tuberculosis	46,104.21	45,746.92
Subsidies to Cities and Towns	490,000.00	487,055.57
Tuberculosis Clinic Units	52,203.85	49,359.98
Chronic Rheumatism	37,229.85	36,402.10
Sanitary Condition of Certain Rivers	1,173.25	820.73
Hurricane and Flood Damage	1,455.88	–
Martin's Pond Investigation	1,290.52	1,034.80
	$1,635,542.38	$1,529,348.45

Receipts for Year Ended November 30, 1940

Licenses, etc.	$12,202.83

State Sanatoria and Pondville Hospital

	Appropriations and Balances	Expenditures	Receipts
Lakeville State Sanatorium	$346,944.07	$339,083.63	$126,372.81
North Reading State Sanatorium	276,920.69	262,147.53	66,269.72
Rutland State Sanatorium	380,360.49	355,577.53	84,641.21
Westfield State Sanatorium	434,287.86	426,352.99	135,904.89
Pondville Hospital	357,142.76	349,029.78	77,752.12

Special Appropriations

	Balance of Appropriation	Expenditures
Lakeville		
Chapter 356, 1938, Item 612		
Fire Protection and Sprinklers	$275.78	$253.01
Chapter 356, 1938, Item 612a		
Sewage Disposal	1,240.42	78.40
Westfield		
P.W.A. Docket 1155, Mass. State Project		
H-102, Cancer and Tuberculosis Group	404.13	—
Chapter 356, 1938, Item 619		
Fire Protection and Sprinklers	279.49	236.07
Pondville		
Chapter 356, 1938, Item 622		
Water Supply	203.82	184.38

Financial Statement Verified
Walter S. Morgan, *Comptroller.*

Respectfully submitted,

Paul J. Jakmauh,
Commissioner of Public Health.

Approved and signed
R. Nelson Hatt
Gordon Hutchins
Francis H. Lally
Richard M. Smith
Richard P. Strong
James L. Tighe
Public Health Council

REPORT OF THE DIVISION OF ADMINISTRATION SERVICES FOR CRIPPLED CHILDREN

Edward G. Huber, M.D.
Assistant Director of Public Health Administration

The personnel of the Unit, a subdivision of the Division of Administration, consists of the director of the Unit, a supervisor of clinics for crippled children, six public health nursing supervisors (physiotherapists), two public health social work supervisors, and a staff of four clerks and stenographers. There are ten clinic consultants (orthopedic surgeons) who are on a part-time basis.

The Unit completed its fourth year on September 1, 1940. The increase in the number of children under active care since September 1, 1936 is shown in Table 1. More children were admitted to service in 1937 than in any subsequent year. There has been since that year a steady decrease in the annual number of new cases admitted. Nevertheless the number of children under active care is still increasing. This is because almost all of the children admitted to service require treatment over a period of years. Experience has shown that a little less than half the patients are still under care at the end of four years, slightly more than half at the end of three years, about two-thirds at the end of two years, and eighty-five per cent at the end of the first year. The cost of such long-continued treatment, including hospitalization, physiotherapy treatment, and apparatus, is prohibitive for all except those whose incomes are much better than average.

This service is primarily a curative one but its purpose is to restore crippled children to an active life so that they can be self-supporting and self-respecting, and not be a burden to society. The medical profession of the Commonwealth has actively supported the program, realizing that their efforts alone, unsupported by funds for hospital expenses and braces and appliances, are inadequate. The fact that the Department of Public Health has included in its professional staff for the care of crippled children, only personnel of the highest qualifications, convinces the medical profession that the service given is entirely adequate. The success of the program is due in no small measure to the co-operation of the physicians of the Commonwealth.

Table 1. — *Increase in Number of Patients under Active Care*

Year	New Cases Admitted	Discharged	On Active List on Date Specified		Increase
1936 (4 mos.)	223	39	1–1–37	184	
1937	499	147	1–1–38	536	362
1938	488	182	1–1–39	842	306
1939	335	292	1–1–40	885	43
1940 (11 mos.)	288	254	12–1–40	919	34
Total	1,833				

During 1940 eleven clinics were conducted at each of the ten centers.

Table 2. — *Location of Clinics and Respective Consultants*

City	Hospital	Clinic Consultants
Brockton	Brockton Hospital	Dr. George W. VanGorder
Fall River	Union Hospital	Dr. Eugene A. McCarthy
Gardner	Henry Heywood Memorial Hospital	Dr. Mark H. Rogers
Haverhill	Hale Hospital	Dr. William T. Green
Hyannis	Cape Cod Hospital	Dr. Paul L. Norton
Lowell	St. John's Hospital	Dr. Albert H. Brewster
Northampton	Cooley Dickinson Hospital	Dr. Garry deN. Hough, Jr.
Pittsfield	St. Luke's Hospital	Dr. Frank A. Slowick
Salem	Salem Hospital	Dr. Harold C. Bean
Worcester	Worcester City Hospital	Dr. John W. O'Meara

The work of the Unit was distributed among the respective clinics as shown in Table 3.

Table 3. — *Work of Respective Clinics Dec. 1, 1939–Nov. 30, 1940*

Clinic	Clinic Visits	New Cases	Admitted to Hospital
Lowell	240	39	37
Salem	147	20	10
Haverhill	210	22	23
Brockton	182	35	17
Fall River	203	36	30
Hyannis	203	26	17
Worcester	195	35	24
Gardner	137	24	23
Pittsfield	142	24	21
Northampton	229	33	27
Metropolitan Area	16	13	5
Totals	1,904	307	234

During the year 4,500 physiotherapy treatments were given the patients examined at clinics for whom such treatment was prescribed. The six Public Health Nursing Supervisors (physiotherapists) made 2,675 follow-up visits for checking up on patients, etc. Braces and appliances were provided for 272 patients.

Admissions to hospital were distributed among the hospitals enumerated in Table 4.

Table 4. — *Admissions to Hospitals and Costs, Dec. 1, 1939–Nov. 30, 1940*

Hospital	Admissions in 1940	Cost During Year Ending 7–1–40	Cost During 4 Years Ending 7–1–40
Audubon Hospital, Boston	3	36.50	36.50
Boston City Hospital, Boston	–	–	188.50
Peter Bent Brigham, Boston	11	921.15	1,458.20
Robert Breck Brigham, Boston	in 1939	510.75	510.75
Cambridge Hospital, Cambridge	35	6,871.00	11,848.10
Cape Cod Hospital, Hyannis	X-rays	102.60	402.40
Children's Hospital, Boston	34	5,229.50	10,687.80
Cooley Dickinson, Northampton	19	1,513.32	1,513.32
Hale Hospital, Haverhill	X-rays	51.85	148.35
Heywood Memorial, Gardner	16	322.75	1,879.97
Lakeville State Sanatorium, Middleborough	–	–	8,624.00
Massachusetts Eye & Ear Infirmary, Boston	5	499.50	2,301.55
Massachusetts General Hospital, Boston	13	1,623.65	12,734.15
Massachusetts Memorial Hospitals, Boston	1	125.00	125.00
New England Deaconess Hospital, Boston	1	49.50	49.50
St. John's Hospital, Lowell	28	1,708.80	4,957.80
St. Luke's Hospital, Pittsfield	16	1,678.00	9,392.50
St. Vincent's, Worcester	–	–	1,124.50
Salem Hospital, Salem	9	680.50	2,441.00
Springfield Hospital, Springfield	–	24.00	489.00
Union Hospital, Fall River	22	2,167.75	6,328.40
Wesson Memorial Hospital, Springfield	3	539.80	3,614.55
Worcester Memorial Hospital, Worcester	–	–	1,806.00
Worcester City Hospital, Worcester	18	3,302.50	8,618.49
Total	234	27,958.42	91,280.33

These patients were in hospital a total of 6,510 days. Operations were performed on 173 patients; 21 were admitted for study; 25 for application of cast, or brace adjustment; and 23 for specialized treatment. Braces and appliances were purchased at a cost of $2,844.34.

The Orthopedic Unit has two advisory committees, a General Advisory Committee and a Technical Advisory Committee. Their respective memberships are as follows:

General Advisory Committee

Arthur G. Rotch, Commissioner of Public Welfare
R. O. Small, Director of Division of Vocational Education, Department of Education
Herbert A. Dallas, Supervisor of Rehabilitation, Department of Education
Miss Edith I. Cox, Superintendent, Robert Breck Brigham Hospital
Dr. Bronson Crothers, 300 Longwood Avenue, Boston
Dr. John E. Fish, Superintendent, Massachusetts Hospital School, Canton
Miss Dorothy J. Carter, Community Health Association, 137 Newbury Street, Boston
Rev. Thomas J. Brennan, Superintendent, St. Elizabeth's Hospital, Brighton
Rev. Richard J. Quinlan, Diocesan Supervisor of Schools, 75 Union Park Street, Boston
Dr. Robert B. Osgood, 372 Marlboro Street, Boston
Dr. T. Duckett Jones, House of Good Samaritan, 25 Binney Street, Boston

Technical Advisory Committee

Dr. Bronson Crothers, 300 Longwood Avenue, Boston
Dr. Frank R. Ober, 234 Marlboro Street, Boston
Dr. W. Lloyd Aycock, Harvard Medical School, 25 Shattuck Street, Boston
Dr. R. Nelson Hatt, 146 Chestnut Street, Springfield
Dr. T. Duckett Jones, House of Good Samaritan, 25 Binney Street, Boston
Dr. Robert B. Osgood, 372 Marlboro Street, Boston
Dr. Kenneth D. Blackfan, 300 Longwood Avenue, Boston
Dr. Conrad Wesselhoeft, 315 Marlboro Street, Boston
Dr. Lloyd T. Brown, 372 Marlboro Street, Boston
Dr. James W. Sever, 321 Dartmouth Street, Boston

In the Technical Advisory Committee there is an orthopedic subcommittee composed of the following orthopedic surgeons:

Dr. Robert B. Osgood, Boston
Dr. R. Nelson Hatt, Springfield
Dr. James W. Sever, Boston
Dr. Lloyd T. Brown, Boston
Dr. Frank R. Ober, Boston

The members of the Orthopedic Subcommittee participated actively in the work of the Unit, not only by frequent advice, but by each visiting two of the clinics. The purpose of these visits is to review the work done during the past year and then to recommend to the Department any advisable changes in professional care or in administration. The clinic visited makes special preparations for this visit by presenting not only those patients who demonstrate excellent results but also those who have presented difficult problems. In 1940 the clinics were reviewed as shown in Table 5.

Table 5. — *Clinics Reviewed in 1940 by Orthopedic Subcommittee*

Clinic	Visited by	Date
Fall River	Dr. Frank R. Ober	May 27
Salem	Dr. Robert B. Osgood	September 3
Lowell	Dr. Frank R. Ober	September 6
Hyannis	Dr. Lloyd T. Brown	September 24
Haverhill	Dr. James W. Sever	October 2
Northampton	Dr. Robert B. Osgood	October 16
Worcester	Dr. R. Nelson Hatt	October 18
Pittsfield	Dr. R. Nelson Hatt	October 21
Gardner	Dr. Lloyd T. Brown	November 12
Brockton	Dr. James W. Sever	November 14

On November 25, 1940, a conference was held, presided over by Dr. Paul Jakmauh, Commissioner of Public Health, at which the work of the Unit was discussed in the light of the reports made by the members of the Orthopedic Subcommittee after their clinic visits. Present at the conference, besides the Subcommittee, were all but one of the clinic consultants, and the members of the administrative staff of the Department. Several constructive recommendations were made and are being put into effect.

There are regular conferences with the fieldworkers as a group, at which their work is reviewed and matters of policy discussed. A rating system has been devised which permits judging the efficiency of the members of the field staff.

On October 1, 1939 the Act Requiring the Reporting of Congenital Deformities and Other Crippling Conditions in Infants became effective. During 1940, crippled infants were reported as shown in Table 6.

Table 6. — *Congenital Deformities and Other Crippling Conditions in Infants, Dec. 1, 1939–Nov. 30, 1940*

Orthopedic	150 [1, 2]
Plastic	33 [1]
Other	11 [2]
Mongolian Idiot	5
Total	199

[1] 3 reported as both orthopedic and plastic.
[2] 3 reported as both orthopedic and other.

During the year the staff gave eleven lectures to various organizations on the subject of Services for Crippled Children, and eight radio programs were broadcast.

The Orthopedic Unit maintains a State Register of Crippled Children. The names of all crippled children known to the Department of Public Health for whom an accurate diagnosis by a physician has been made are on this list, which is not public. This list does not merely include children who are eligible for care by the Orthopedic Unit; it includes any crippled child known to the Department whether the child is under adequate care or not. This is done so that the Orthopedic Unit will know exactly the problem of the Commonwealth in respect to its crippled children. At the end of the current year there were 5,900 names on the register. In all probability this is scarcely more than half of the crippled children in the State. However, there has not been a time since the Orthopedic Unit was established when there was a waiting list for orthopedic treatment. In other words, every patient discovered, who needed care, was given treatment at once. The Orthopedic Unit does only a comparatively small part of the total work done in the Commonwealth by physicians, clinics, private agencies and by the Department of Public Health at its Lakeville State Sanatorium.

As the Department of Public Health proceeds with its policy of localizing health work in the State Health Districts, Services for Crippled Children will likewise be localized. All local administration of the program will be in the hands of the District Health Officer. The professional conduct and decisions on policy will remain a function of the Orthopedic Unit.

During the coming year it is hoped to place in operation a program for the care of children suffering from acute rheumatic fever. A State Plan has been made, which has been approved by the Children's Bureau. The funds will be provided by that Agency. As soon as this Plan is thoroughly understood and appreciated in the Commonwealth, it seems certain it will be adopted. The few studies which have been made on the incidence of this disease show that it exists most commonly among the low income classes and that the sufferers are very inadequately cared for at the present time.

LOCAL HEALTH ADMINISTRATION

John J. Poutas, M.D.
Assistant to the Commissioner

In the "Report of the Special Commission to Study and Investigate Public Health Laws and Policies," House Bill 1200, 1936, it was recommended that a separate Division of Local Health Administration be established and that the District Health Officers and Public Health Nurses be transferred to this Division.

The purpose behind this recommended change was to secure more efficient public health practices in all communities of the State, small and large, by establishing the District Health Officer as an administrative officer responsible for State Public Health activities in his District. This is provided basically in the General Laws, Section 4 of Chapter 111. Certain legally specified duties of several Divisions not readily subject to co-ordination by the District Health Officer would remain outside of his sphere of control.

The following improvements, it was thought, would be attendant upon such recommended changes:

1. More effective co-ordination and distribution of State Health Department activities in the Districts.
2. Reduction to a minimum of duplication of promotional efforts.
3. More thorough insight into the Public Health practices and needs of the respective communities.
4. More effective effort where indicated to improve existing conditions.

The first definite progressive step in following out these particular recommendations of the Special Commission was taken on October 1, 1940. At this time an Assistant to the Commissioner was appointed, whose duty it is to effect the success of the District plan. As each successive District is organized the Health Officer is to be transferred from the Division of Communicable Diseases to the Division of Administration.

On October 1, 1940, the position of Supervisor of Medical Social Service, for some time vacant, was filled. At that time this position was transferred from the Division of Adult Hygiene to the Division of Administration. In the near future it is planned to fill the position of Chief Public Health Nursing Supervisor, at which time the Supervisor Nurses in the Department will be transferred from the Division of Child Hygiene to the Division of Administration. The Assistant to the Commissioner has certain administrative responsibilities, under general direction of the Commissioner, relative to these two positions.

The Worcester Health District (No. 5) was chosen as the first to put into operation the new plan for the following reasons: (1) it comprises fifty-seven cities and towns, exclusive of the ten in the Nashoba Health Unit, and has long been recognized as much too large for even routine District Health Officer activities; and (2) it is near enough to Boston to be under immediate administrative control, yet far enough to permit of considerable freedom of activity, setting up ideal conditions for a trial of the administrative changes involved.

To facilitate the success of the plan by releasing the District Health Officer from many of his routine duties the position of Assistant Health Officer was created and filled. In addition, a Health District Sanitary Officer was assigned to the Worcester District Office. It is his duty to carry out certain assignments relative to environmental sanitation; for example the promotion of a more wide-spread practice of pasteurization on the part of milk producers and dealers and the examination of private water supplies and systems of sewage disposal. Two Supervisor Nurses, a Nutritionist, and a Physiotherapist, are considered as constituting the District Health Officer's permanent, full-time staff. Specialists working out of various Divisions are considered as being part of the District Staff when carrying out activities in the District.

Suitable office space was engaged at Room 505, 476 Main Street, Worcester and complete equipment was installed. The staff was provided with a permanent full-time clerk-stenographer with the knowledge that, without doubt, an additional clerk-stenographer would soon be needed.

It may be briefly stated that in the District plan Division Directors continue to be responsible for the technical content of field activities. Co-ordination of program, however, rests with the District Health Officer who is responsible to the Commissioner of Health for its success or failure. It is to be remembered that the only new positions are as follows: Assistant to the Commissioner, two full-time clerk-stenographers, Assistant District Health Officer, and a Health District Sanitary Officer — the latter two will be established only where needed. The plan is developing very satisfactorily, and will be introduced as soon as possible into other Health Districts. At the close of the year consideration was being given to its immediate extention into the Greenfield area, then, in all probability, into the Southeastern area.

REPORT OF THE DIVISION OF ADULT HYGIENE

Herbert L. Lombard, M.D., *Director*

A. Outstanding Accomplishments

A cancer control program must have three objectives; first, prevention of cancer; second, early recognition and treatment of the disease; and third, studies to learn more about the disease. To attain these objectives, diagnostic cancer clinics, treatment centers, research, and education are necessities. Education should incite the individual to action. Diagnostic facilities must be available to him, and treatment centers if he is found to have the disease. Research may cover both studies of the causative factors of the disease and evaluations of the methods used in a cancer control program. Every activity should be subjected to appraisal to determine the worth-whileness of its continuation. The Massachusetts Cancer Program attempts to integrate cancer control by following these general procedures.

A continuation of the shorter period of delay between first recognizable symptoms and visit to physician first noted in 1936; a far greater use of the Tumor Diagnosis Service; more individuals coming to the clinics than ever before; sixty teaching clinics attended by 1,328 physicians; and an extension of the Co-operative Cancer Control Committees — were the principal measures of achievement of the Division of Adult Hygiene for 1940. These will be discussed in detail under the respective divisions of the report.

The delay between the first recognizable symptoms of the disease and the time when the patient presents himself to a physician is one measure of the effectiveness of public education in cancer. While it is impossible to obtain such a figure from all individuals with caner, it is believed that the sample obtained at the Massachusetts State-aided cancer clinics is sufficiently representative to warrant a more or less general statement. Between 1927 and 1935 this period of delay averaged 6.5 months; between 1936 and 1939, 5.3 months; and in 1940, 4.6 months. This is still too long a period for an individual with cancer to delay before consulting a physician, but it is a decided improvement over six and a fraction months.

Another estimate of a similar nature is the percentage of individuals who go to their physicians within the first month of recognizable symptoms. In 1940, 21.0 per cent of the cancer patients went to their physicians within a month of their first symptoms.

The interval between the first recognizable symptoms and treatment should be short. This comprises the sum total of delay between first symptoms and first visit to physician, between first visit to physician and first visit to clinic, and between first visit to clinic and treatment. Only a small percentage of individuals receive therapy within one month of symptoms. In the early years of the clinics, this percentage was 3.1; in 1939 it had increased to 5.8. The percentage of individuals who received therapy within four months has increased from 20.3 in the early years of the clinics to 30.7 in 1939. As the clinic figures include attendance through December 31, 1940, and as treatment for many of the December cases will be given in 1941, it is impossible to cite the 1940 figures in this part of the table.

More and more the physicians of Massachusetts are taking the lead in referring patients to the cancer clinics. In the early days of the movement many patients came to the clinics because of newspaper publicity, and the percentage referred by physicians was relatively small. In the first year of the clinics the physicians referred 44.8 per cent of all cancer patients attending the clinics. In the last five years approximately 85 per cent of all cancer patients have been referred by their physicians.

The total attendance at the cancer clinics in 1940, including new and old cancer patients as well as noncancer patients, was 21,820. Of the new patients, about one-third had cancer; of the old patients, a much larger percentage had cancer. Many of the visits of the old patients were repeat visits of the same individuals.

Of the group of 302 cancer patients who came in 1927, 17.2 per cent were alive thirteen years after coming to the clinics. This does not necessarily mean that all of them were cured cases, but most of them undoubtedly were. About half of these cures were of sites other than skin.

Teaching clinics were not instituted until 1933. Their numbers have increased and at the present time all the physicians of Massachusetts have the opportunity to see groups of cancer cases discussed by experts in the field.

The Tumor Diagnosis Service received more specimens in 1940 than in any other period of its history. Seven hundred and ninety-eight doctors made use of this service as well as many hospitals.

During the last few years the improvement in the female age adjusted death rate has been frequently reported. In order to obtain some measurement of what this has accomplished, a trend line was constructed mathematically from 1900 to 1926. This line was extrapolated through 1940. The observed deaths from cancer from 1927, the first year of clinic operation, including 1940, were 1,120 less than the expected, estimated from the trend line.

All these figures indicate that the present program is gradually accomplishing its end. The combined efforts of the medical profession and the public are being felt and cancer control today seems nearer than ever before.

Table I. — *Outstanding Accomplishments*

	Average 1927–35	Average 1936–39	1940
Number of State-aided cancer clinics	12	21	23
Number of teaching clinics	8[1]	62	60
Attendance of physicians at teaching clinics	229[1]	1,344	1,328
Number of specimens diagnosed by Tumor Diagnosis Service	2,813	3,210	3,907
Number of doctors using Tumor Diagnosis Service	421	675	798
Admission rate per 100,000 population of cancer patients at State-aided cancer clinics	17.7	34.1	41.5
Number of cancer patients attending cancer clinics	758	1,510	1,806
Percentage of cancer patients receiving treatment within one month of first symptoms	3.1	3.2[1]	5.8[2]
Percentage of cancer patients receiving treatment within four months of first symptoms	20.3	26.0[1]	30.7[2]
Median delay, in months, of cancer patients between first symptoms and visit to physician	6.5	5.3	4.6
Percentage of cancer patients going to physician within one month of first symptoms	15.0	18.6	21.0
Percentage of cancer patients attending cancer clinics referred by physicians	61.1	84.7	86.4
Percentage of cancer patients alive thirteen years after attending cancer clinics			17.2

[1] three-year average
[2] 1939

B. Epidemiology and Biometrics

1. *Biometric Research* — The principal data for research in this Division are obtained from the death records, hospital records, clinic records, questionnaires to physicians, records of contacts with individuals in the educational program, and personal interviews in house-to-house survey visits. This material is transferred to punch cards, tabulated, and later subjected to critical analysis.

2. *Study on Cancer Morbidity* — The study on cancer morbidity which has been carried on concurrently with other work for eight years will be reported on in the immediate future. This study covers a possible relationship between environmental factors and cancer. Records have been obtained from cancer patients in the Pondville Hospital and from a control group by house-to-house visits. Records of those having cancer with their respective controls were matched for age and sex. Further subdivisions were made by dividing the total cancer cases by type of cancer. The percentage for the given environmental variable among the cancers of the cervix, for example, was compared with the percentage of the same variable among the matched controls, and the difference was subjected to statistical analysis to determine whether or not it was significant.

3. *Revision and Development of Codes for Cancer Hospital Records* — The addition of the new position of biometrician made it possible for the incumbent of this position to devote much time for several months to revising and developing the codes for cancer hospital records, the first draft of which was completed last year. These are the first codes of their kind and constitute an example to which others in charge of cancer records are looking for a pattern.

4. Follow-Up Study of Cancer Death Records — The epidemiological study of the cancer death records has been developed during this year in a new manner and with a double objective. The former study of these records from 1932 to 1937 was done by collecting in 1933 cancer death records for 1932 and checking every item with the physician, the family, hospitals, and others who had worked on the case. The present study is based on the death records collected as rapidly as received in the local record offices. This has made it possible to contact the family, the physician, and hospitals which had cared for these cases within days, weeks, or at the most, months of the deaths. Improved accuracy because of the reduced period of time involved from death to interview has been the result. The two objectives of the study are: first, to measure the improvement in the reporting of all items of information on these records, and second, to measure the improvement in response of individuals to the facilities for the care and treatment of cancer,— an index of the several parts of the Massachusetts Cancer Program.

5. Study of All Diseases by Standardized Death Rates — The adjusted death rates for all diseases for all states were computed in preparation for a more comprehensive study of health and disease which is pending.

6. Biometric Appraisal of Social Service — A study to evaluate social service in the cancer clinics was begun this year. This study is described in detail under the section, "The Place of Social Service."

7. Study of Cancer Records in Eighty-six Hospitals — The periodic check-up of the cancer records in eighty-six general hospitals throughout the State was begun this year in April. It will be interesting to study the differences between this study and the two similar ones previously made. The analysis will be made in 1941.

8. Living Cancer Report — The regular annual follow-up report of cancer clinic patients alive on July 1, 1940 was completed by social service several months later. With this new information, the table showing the percentage alive at yearly intervals following first admission to the clinic was brought up to date. The complete follow-up report of the 4,928 individuals still living whose condition had been diagnosed as cancer at the clinics required nearly six thousand separate contacts or visits by social service.

With nearly one-fifth of all cancer patients who came to the clinics in 1927 alive thirteen years later, and with the average symptoms of nearly a year's duration before coming to the clinic, it is apparent that much more is being accomplished in the control of cancer than is realized by the general public.

TABLE II. — *Percentage of Patients with Cancer Attending State-aided Cancer Clinics Alive at Yearly Intervals Following Clinic Admission*

	1927–1939
Lost or unknown	2.2
Alive 1 year after	65.0
Alive 2 years after	51.9
Alive 3 years after	45.7
Alive 4 years after	41.8
Alive 5 years after	38.6
Alive 6 years after	35.5
Alive 7 years after	32.7
Alive 8 years after	29.5
Alive 9 years after	27.4
Alive 10 years after	26.2
Alive 11 years after	24.2
Alive 12 years after	22.9
Alive 13 years after	17.2

9. Publication of Study on Cancer Clinic Follow-up Records — The report on the evaluation of the several methods for estimating the efficiency of the Massachusetts Cancer Program which was discussed by Miss Eleanor J. Macdonald at the Pittsburgh meeting of the American Public Health Association in 1939 was published in the May issue of the *American Journal of Public Health.* It was entitled "Evaluation of Cancer Control Methodology" and was under the joint authorship of Miss Eleanor J. Macdonald and Miss Frances A. Macdonald.

10. Training of Selected and Duly Qualified Personnel in Biometry — The practice of training personnel in biometric work, so successful in the past, has been continued. Individuals with mathematical background, most of them college graduates, who offer to volunteer their services in return for what knowledge they can obtain, work in the Division. The work they do more than compensates for the time spent in lecturing to them on biometric methods. Some of these individuals stay only a few weeks; the longest period was one year.

11. Epidemiological Consultation — All research papers prepared by Pondville physicians in which statistics are used are reviewed by this Division to determine the statistical soundness of the conclusions drawn. In addition, many physicians throughout the State are requesting the use of this same service to have papers they prepare read over and verified statistically.

12. Supervision of Statistical Methods at Pondville — When statistical material for papers is needed by the members of the Pondville staff, the statistical staff of that institution is informed of their needs. The statistical staff, in turn, applies to this Division and is advised of the best and quickest methods for obtaining these data.

13. Punching and Tabulating of Data for Other Divisions — As in other years, the punching and tabulating of data for other divisions has been done during this year.

C. Cancer Clinics

1. Regular State-aided Cancer Clinics — Each of the State-aided cancer clinics has functioned regularly throughout the year as a group consultation unit, and each one in its separate environment has shown remarkable progress in co-ordination of effort. These clinics are administered by committees appointed by the local medical organizations. These committees have charge of the administration connected with their respective clinics, but in all cases they conform at least with a minimum requirement set by the Department. These are: (a) Group Diagnosis, (b) Free Diagnostic X-ray to the Indigent, (c) Social Follow-up, (d) Uniform Records, (e) Teaching Clinics.

Every physician in the Commonwealth may bring or send his patient to the clinic for free consultative service with the group. Each case is returned to the physician who sent him to the clinic and this physician decides whether he desires the assistance of social service in securing treatment for his patient. The larger clinics meet once or twice a week, but all clinics must meet at least twice a month. At least four times a year, at the discretion of the clinic committee, some form of teaching for the community physicians is required.

Physicians of the State have co-operated in this program by referring an ever increasing percentage of patients to the clinics. In 1940 the percentage of patients referred by physicians to the clinics was 80.8.

The total clinic attendance for the year was 21,820. Of these, 16,204 were return visits of old patients. Of the new clinic attendance of 5,616, 1,884 were cancer and 3,732 were noncancer.

2. Teaching Clinics — During the year sixty teaching clinics were held. As in 1939, the effort in 1940 was to consolidate the position of the regular clinic meetings.

Table III. — *Teaching Clinics*

Clinic	Number Held in 1939	Number Held in 1940
Boston Dispensary	3	2
Brockton	4	4
Fall River	3	4
Fitchburg	11	9
Gardner	5	6
Gloucester	3	4
Greenfield	3	2
Hyannis	3	3
Lawrence	5	5
Lowell	0	1
Lynn	3	2
New Bedford	2	1
Newburyport	8	6
North Adams	2	2
Northampton	1	–
Pittsfield	1	1
Quincy	0	2
Salem	4	3
Westfield	2	3
Worcester	0	2
Total	63	62

D. The Place of Social Service

Medical social service is one of the most important parts of the cancer clinic program. At the first visit of a patient to a cancer clinic, information is obtained by the social worker regarding the motivating cause for coming to the clinic, the symptoms and their duration, identifying data — age, sex, whether other doctors have been consulted, the interval that has elapsed since onset of symptoms prior to first consultation with the physician and visit at clinic, and reasons for delay in seeking diagnosis.

One of the physicians in charge of the clinic dictates the medical findings and recommendations for each patient. The patient is returned to his physician and treatment is determined by him, and arrangements for carrying out this treatment are made in some cases with, and in some cases without, the assistance of social service. The medical social worker in the cancer clinic aids the doctor in securing for his patient the utmost that medical facilities have to offer.

Nearly every patient presents an individual problem to the social worker and in each case the social worker tries to adapt the patient's needs to the existing facilities. She utilizes existing community resources, social and other agencies, as well as resources within the patient's own group or within himself in an effort to meet his need. In these ways the medical social worker is aiding the physician in his fight against a disease in which prompt carrying out of his orders is of such vital importance. She acts in conjunction with the doctor as an auxiliary unit.

The social worker follows each cancer patient, obtains hospital transcripts of operations and other therapy, and keeps in touch with the patient throughout life. If the patient moves but is still within the State, the social follow-up is continued personally. If the patient leaves the State, attempts are made to contact him through existing agencies in the state to which he has moved.

1. *Study to Determine Relative Case Loads of Different Workers* — As in every phase of the work, a system of appraisal is being developed to evaluate the component parts of social service. A comprehensive form has been devised and put into effect which will determine the relative case loads of the different workers, the extent to which co-operating agencies in every community are being contacted, and the number of cases regularly reporting in each clinic as well as those that have been remiss in attending.

2. *Evaluation of Social Service Follow-up* — The adequacy of the follow-up work of social service will be determined by a biometric measurement and reported on during the coming year. This will make available an invaluable appraisal not only to this Division but also to other programs whose experience in years is still so much less than that of Massachusetts.

3. Study from Existing Material to Determine Ways of Improving the Social Worker's Place in the Clinic Setup — The importance of at least an elementary knowledge of biometry among social workers is stressed among the cancer clinic social workers, since evaluation of all phases of the work depends on the accuracy of the records. A knowledge of how these data are handled after they leave the social worker's hands has a tendency to stimulate more accurate reporting on the part of social service. At regular intervals all the cancer clinic social workers meet with the Director of the Division and take his course prepared for them in biometric methods. At the conclusion of these study periods, questions relative to the clinic records themselves are discussed. This also assures uniform interpretation throughout the twenty-three clinics. From the social workers' records available to us, an exhaustive analysis is going to be made to determine ways of improving social service in the present clinic setup.

E. Tumor Diagnosis Service

1. General Report — During this year there was an increase of 287 in the number of surgical specimens, a total of 3,907 being examined. During 1940, 798 different doctors and 115 different hospitals have made use of the Tumor Diagnosis Service. This is an increase of sixty in the number of doctors using the Service over 1939.

The Laboratory is under the supervision of Dr. Shields Warren and has continued under the immediate charge of Dr. Olive Gates. Special attention during the year has been given to the skin tumors and tumors of lymph nodes. In the study of the skin tumors the striking importance of size and the treatment of the lesions has been brought out. Thus, there are only 18 per cent five-year cures for epidermoid carcinomas over 5 cm. in diameter and 93 per cent cures for those under 1 cm. in diameter.

A detailed study of the so-called "reticulum cell sarcoma" of lymph node has been carried on with the co-operation of Dr. Juan P. Picena of the University of Rosario, Argentina, and rather more satisfactory criteria established for the diagnosis of this type of tumor than have existed heretofore.

There have been a number of consultations with physicians using this Service about cases of special interest to them.

2. Tables — A list of the hospitals and the number of doctors, by towns, submitting tissue to the Laboratory is shown in Tables XXII and XXIII.

F. Regular Contacts with Physicians

1. Monthly Cancer Bulletin — The popularity of the *Cancer Bulletin* as a medium for the dissemination of information on cancer is emphasized by the growth in the number of physicians who wish to receive it. Approximately half of the physicians in the State have requested to have this Bulletin mailed to them. Its contents vary from month to month and are planned to meet a need as well as to comply with the suggestions received from the physicians to whom it is sent.

2. Cancer Manual for Practitioners — On May 1st a cancer manual for practitioners was sent to every physician in Massachusetts. This was compiled by the Committee on Publication in collaboration with the Massachusetts Branch of the American Society for the Control of Cancer, the Massachusetts Medical Society, and the Massachusetts Department of Public Health. Several articles were contributed by members of the staff of this Division.

3. Periodic Appraisal of Cancer Program — As rapidly as possible all the physicians residing in those sections of Massachusetts which have been organized into the Co-operative Cancer Control Program are interviewed with the intention of securing their co-operation, participation, and suggestions. In the course of these interviews many valuable suggestions have been received which have been incorporated subsequently over the whole State. The educational program is meeting with almost unanimous approval. The clinics and methods of hospitalization in the cancer program are also well-liked by the physicians.

4. Immediate Response to Requests for Cancer Talks — The enthusiastic response of the Massachusetts physicians to invitations to speak at local Co-operative Cancer Control meetings has continued and undoubtedly accounts for much of the progress of the program. These talks number thousands and this Division again wishes to acknowledge to the seven thousand physicians its appreciation not only for the time and effort involved, but for the generous and consistent enthusiasm shown.

G. Public Health Committee of the Massachusetts Medical Society

The Director of the Division was reappointed to serve on the Committee on Public Health of the Massachusetts Medical Society. There were several meetings during the year. Through this committee a closer co-operation between the Massachusetts Medical Society and the Massachusetts Department of Public Health has been firmly established. The radio series known as "The Green Lights to Health," which is a series sponsored by the Massachusetts Medical Society through this committee and the Massachusetts Department of Public Health, has continued to grow in public favor.

H. Book Reviews

During 1940 the Director prepared two book reviews for *The New England Journal of Medicine.* These volumes were placed in the George H. Bigelow Memorial at the Boston Medical Library as a gift from the Director. These books were:

Public Health Administration in the United States by Wilson G. Smillie
Introduction to Medical Biometry and Statistics (Third Edition) by Raymond Pearl

The Director prepared a book review for *Public Health Nursing* on *The Unseen Plague — Chronic Disease* by Ernst P. Boas.

I. Adult Health Education

The experience of the Massachusetts Cancer Program in adult education is coming to be considered a laboratory sample or experiment for the whole field of education of adults in health matters. Here was a single circumscribed problem. The one disease, cancer, occurring primarily among adults, the ultimate cause unknown but with numerous intermediary steps well-known, and knowledge of them cumulatively increasing, was to be explained so as to create enthusiastic interest in those not personally involved and an active sense of urgency of response in those in whom the disease was already suspected.

All the general educational procedures were initiated consecutively and with gratifying effect. Each applied device was measured. The radio was checked by survey in two communities, one without many organized clubs and the other with many. It was learned from this random sample that many individuals were reached through this medium who otherwise would not have been reached. This was one of the more subtle approaches in that while the information was disseminated, the extent of its actual reception was hitherto unrealized.

Large publicized meetings, sponsored by the State cancer program and addressed by individuals famed for their part in the national and international cancer field, were held at large centers in Massachusetts. The newspapers, with their usual willing co-operation, carried extensive publicity in advance and during these meetings. Enthusiasm among the large attending audiences was engendered at the moment of the need and this continued thereafter for a few weeks.

Papers were written and distributed in which discussion of the cancer problem in each of its several phases clarified that section of the problem discussed for those who were reached in this manner. The most common questions asked were grouped with verified answers in a booklet entitled "The Whats and Whys of Cancer." The demand for this was so constant that its reproduction and distribution has run into the hundreds of thousands.

All these steps in disseminating knowledge are of inestimable value in preparing the public for a receptive attitude for a more specific form of approach. In cancer and in other diseases, because of the obviousness of their existence, volumes of ideas and superstitions have grown up about them. These enclose the problem in layers which have to be removed with tact and caution because their presence over long periods of time has given them a certain aura of respectability and truth.

A study of the case records that had accumulated over the early years of the Massachusetts Cancer Program gave a source from which answers might be obtained as to a way of meeting the specific details of this problem. It was found that the individuals with cancer who attended the cancer clinics averaged six months delay before consulting a physician. Those who delayed did not necessarily think they had cancer but they knew that something was wrong. All the expense and effort of the educational media mentioned above had not caused any reduction in the time that these individuals waited after they knew something was wrong. There was one fact that gave hope to the situation at this point. It was found that once a physician saw an individual with cancer, he succeeded in persuading him through personal education with the importance of immediate action. The physicians had succeeded in cutting in half the average length of time individuals waited after they had a diagnosis of cancer.

The next step seemed simple and logical. If the seven thousand physicians in Massachusetts would meet in small groups with the nearly four and one-half million individuals of the State and answer questions, a mutual sense of trust and knowledge would scatter as if by centrifugal force a cancer consciousness, thoroughly wholesome in nature, that would reach every family and every individual in the State. The simplicity of the plan and its dignity and spontaneity have been shown to have universal appeal.

J. Co-operative Cancer Control Program

1. *The Co-operative Cancer Control Committees* — In the first eight years of the Massachusetts Cancer Program it was demonstrated that in order to teach individuals to act without delay in the presence of a physical abnormality which might be malignant, education by personal discussion must be disseminated through the agency of the family physician. Every individual must have an equal opportunity to know exactly what is the present status of knowledge of cancer, so that he may protect himself by the avoidance of delay and the application of this information, and of even more importance, by the use of such preventive measures as the elimination of precancerous lesions and chronic irritation. It was realized fully that this plan was almost Utopian in scope, and that the minuteness of its execution would take tremendous planning and effort. It was realized also that if the physicians of the State would assume this new burden and the individuals in the State would co-operate, after the first two or three years the momentum of this basic form of control would sweep away every vestige of an excuse for failure to secure the best treatment without delay and would result in the restoration to health or the saving of the lives of approximately two thousand individuals annually in Massachusetts alone with the present knowledge.

There are nearly four and one-half million individuals, seven thousand physicians, and three hundred and fifty-one communities in Massachusetts. If every family averaged four members and every physician was interested in this plan, it would be too great a task for the seven thousand physicians to instruct separately each of the more than a million families. In place of this, the organization into Co-operative Cancer Control Committees of the whole State, community by community, was planned so that small groups might meet with local physicians for the purpose of discussing cancer. Each community, regardless of its size, is analyzed carefully before work is begun in it. Its population structure is ascertained by a study of the census figures. Its organized clubs, churches, industries, schools, and general characteristics are understood and recorded from its directory or from a reliable local source. Each of its physicians confers concerning the whole plan with a member of the staff of this Division, and more than 90 per cent in the smaller communities and about 65 per cent in the larger cities give immediate promise of full and sympathetic co-operation. Representative members of the local community give counsel as to whom to approach in order to obtain the most satisfactory response. At this point several trained surveyors of this Division start to make personal calls on representatives of every group in the population — social, fraternal, political, religious, service, labor, military, and racial. This plan is not for a cross section of the State; to work, it must reach everyone. Each individual contacted is told the plan briefly and asked to come to an official organization meeting or to send a substitute. The newspapers carry articles of local interest in connection with the whole plan. A physician gives a talk on cancer, the disease, at the organization meeting and a member of this Division details the plan, again going into the reasons for its efficient operation. The plan is accepted in every town and city, and the community, through its committee and medical profession, assumes its prerogative of local autonomy in the cancer program.

Every one is asked to go back to the group he represents and to urge it to have at least one meeting a year at which cancer is discussed and to which a local physician is invited to speak. The nature of the group determines the form the meeting will take. Some prefer a formal talk, while some wish only a question period. Still others plan for a combination of the two. Whatever an organization wishes in this respect is allowed by the flexibility of this plan. The discussion of cancer is the important fact. Groups are strongly urged to give individuals an opportunity to ask questions. No question is too unimportant for the physician's consideration. It is only by the erasure from the minds of thousands, of the confusion brought about by misconceptions concerning causation and prevention, that the ground may be prepared for the reception of the real story of cancer and its control. The clubs with large memberships are asked to divide up into small units for cancer talks, as it is felt that large groups fail in accomplishing their purpose, because their size precludes the possibility of a question period. In small communities there are usually at least ten clubs; in medium-sized towns they number dozens; and in the cities they number hundreds.

Each representative visited is a member of the large Co-operative Cancer Control Committee. A Central Committee of several members is usually elected, after nomination by a group of local individuals appointed by the chairman at the public meeting. This committee co-ordinates the larger local groups and keeps in contact with this Division. It sends in notices, provided for the purpose, of every meeting, stating the date, the name of the organization, the name of the community, the physician who spoke, and the number in attendance.

The limited staff engaged in this work has retarded the speed of organization. Experience has shown that there is a seasonal period for contact work. Planning for the fall and winter, combined with intensive follow-up, occupies the workers during periods inauspicious for the introduction of new community projects. Of the total 366 existing units in this State, 343 are organized and are carrying on with enthusiasm. This does not mean that every club in every community is complying with alacrity to this appeal to help itself. The majority of the clubs are having their meetings. Those that are not, need and receive more active follow-up. Experience obtained from observation of the clubs organized in the first years shows that in many instances one individual holds back group approval, and once this individual is apprised of the importance and need of cancer education, support is obtained and the group is reached.

There are some adult individuals in almost every community who are not members of any organized group. The committees are attempting to reach these individuals in various ways. Individual clubs in some instances hold open meetings inviting the public when a cancer talk is to be heard. A group of women not affiliated with any club has met in a private home with a physician to discuss cancer, When Co-operative Cancer Control Committees are organized in all the communities in the State, a more uniform effort to reach these unorganized groups will be made.

With 343 units or 94 per cent of the whole State already co-operating in the sixth year of this program, it is possible to evaluate its influence now to a greater degree than was anticipated at its inception. In a program having five phases, the influence of one cannot be separated completely from the others as each activity hinges to some degree on the other. The effectiveness of this type of education over the former type has been manifest from an early period in the Co-operative Cancer Control Committee organization program and has persistently increased. The median delay in months of patients with cancer in the State-aided cancer clinics between first symptoms and visit to a physician, which had not been shortened during the first nine years of the program, was shortened by a month in 1936 and this improvement continued through 1937, 1938, 1939, and 1940. The percentage of cancer patients being referred to the clinics by physicians has increased at a greater rate since the inauguration of this program.

The co-operation of the medical profession has been practically universal. In those instances where a physician has been unwilling to speak, ill health or some substantial excuse has usually accounted for the refusal. Their agreement with the aims and method of this educational program has been almost 100 per cent. Many physicians have requested that they receive the Cancer Bulletin sent out each month by the Division and many have made use of sample talks on cancer which are furnished on request. Several of the physicians who can speak in foreign languages have, in addition to speaking to foreign groups locally, given of their time to travel to other communities to speak before foreign groups when there was no local physician who could speak in the given language.

The laity has an appreciation of the simplicity of operation of this plan and the way in which it is adaptable to all types of organizations. The prompt co-operation of so many organizations in having cancer talks indicates the need many of their members have felt for the intelligent discussion of the problem which the authorized local practitioner can present.

There are certain signs appearing which give promise of an increase in prevention of the disease which is a forerunner of what this program seriously is seeking — prevention rather than cure.

2. *Organization in 1940* —

TABLE IV. — *Growth of Co-operative Cancer Control Committees*

Accumulative Percentages

	Percentage of Communities	Percentage of Population
Organized in 1935	18	22
Organized in 1936	37	34
Organized in 1937	71	49
Organized in 1938	81	59
Organized in 1939	85	74
Organized in 1940	94	83

TABLE V. — *Communities Organized in 1940*

Communities Organized in 1940	Date of Organization	Number of Organizations Co-operating	Number of Contacts Made
Acton	Oct. 10	16	56
Andover	Apr. 22	56	141
Ashland	Sept. 20	21	31
Attleboro	Dec. 12	141	317
Bellingham	Sept. 23	12	28
Boston (Back Bay)	May 28	219	794
(South End)	Nov. 22	211	604
Boxford	Mar. 27	9	24
Braintree	Mar. 28	71	302
Burlington	Oct. 2	8	18
Danvers	May 23	48	147
Grafton	Oct. 14	42	99
Holliston	Oct. 9	27	54
Hopkinton	Oct. 8	17	59
Lincoln	Oct. 3	8	50
Maynard	Oct 21	33	73
Medway	Sept. 25	27	61
Natick	Nov. 6	67	208
Needham	Feb. 29	63	195
Norwood	Nov. 7	82	172
Reading	Nov. 13	59	139
Saugus	June 5	79	190
Sherborn	Oct. 28	10	21
Southborough	Oct. 2	17	24
Stoneham	Dec. 6	51	113
Stoughton	Oct. 15	55	95
Sudbury	Sept. 30	18	33
Watertown	Mar. 7	82	239
Wayland	Oct. 7	27	62
Wellesley	Dec. 10	56	300
West Newbury	Apr. 9	17	53
Westborough	Nov. 20	35	85
Westford	Sept. 24	22	68
Weston	Oct. 17	16	75
Westwood	Oct. 18	24	61
Weymouth	Nov. 26	113	255
Total . . . . 36 in 1940		1,859	5,246

3. Follow-up Work — After a community is organized the Division keeps in touch with the Central Committee. During 1940 the staff has devoted some of its time to augmenting committee membership in organized communities. When the follow-up worker visits an organized community and finds a committee relatively inactive, she meets with the committee, discusses the hoped for optimum functioning of the plan once again, and usually either stimulates the inactive members to new interest or obtains a resignation so that an inactive individual may be replaced by one more acutely interested. The follow-up worker also has representatives of newly discovered organizations added to the committee and, in general, affects the revitalization so that interest in the plan may continue. Some communities need very little follow-up; others need to be practically reorganized.

During 1940 follow-up activities were conducted in twenty-four communities with 523 co-operating organizations.

4. Contacts with Physicians in Connection with Co-operative Cancer Control Committees — Physicians, in those organized communities, who are to be asked to speak are interviewed personally by a member of this Division. In the smaller communities it was possible to interview every individual physician before the inauguration of the plan locally. In the larger cities such as Boston, for example, owing to our small personnel this was not possible. Boston, which has been organized as sixteen separate units, has a large proportion of the physicians in the State in residence. All of them were reached last year by letter and a large percentage of them have been reached during 1940 by personal interview. In addition to this, several medical societies in the different sections of Boston and of the State have invited the Division Director to address them and discuss with them their part in this program. At these meetings the physicians have expressed their willingness to give talks on cancer to small groups when they are asked. It is particularly heartening to find that physicians, whether they be general practitioners, specialists in fields other than cancer, or specialists in the cancer field itself, are responding with uniform enthusiasm and co-operation. The response of the physicians and the public, the decrease in the period of delay before consultation with a physician, the increased use of facilities available for diagnosis and treatment — are all favorable indices in the control of cancer in Massachusetts. As more communities become organized and the new workers become valuable with experience and are available to take part in the follow-up work of the communities already organized, great hope is felt for the outcome in this State.

K. Cancer Month

The month of April was set aside by Presidential proclamation as Cancer Month. By experience it has been learned that the effectiveness of the Massachusetts Cancer Program depends on a day-by-day consistency of effort. As a gesture of national co-operation, the Massachusetts Cancer Program publicized its usual activities during Cancer Month. There were seventy-seven regular State-aided cancer clinics and eight teaching clinics held. There was a total of 1,994 patients in attendance at the clinics. The follow-up work of previously organized educational committees in the organized communities throughout the State was concentrated on during this period. Small local cancer meetings were held throughout the State.

The *Cancer Bulletin* was sent to the three thousand members of the medical profession requesting it. The Tumor Diagnosis Service examined 358 specimens. Pondville Hospital and the Cancer Section of the Westfield State Sanatorium were both filled to capacity.

L. Radio

1. Massachusetts Medical Society Broadcasts — The Massachusetts Medical Society broadcasts are prepared by members of the Medical Society. Mrs. La Rocca, from this Division, acts as secretary to the Medical Society Committee and makes the necessary arrangements with the station. There were thirty-two broadcasts given during the year over Station WAAB.

2. Health Forum — This broadcast continued through the year, but it was necessary to change stations.

M. Newspapers

1. Health Forum — The Health Forum was carried this year by ten newspapers throughout the State. The Forum consists of copies of the addresses prepared by the members of the Department and given on the Health Forum period over the radio.

2. Publicity in Connection with Co-operative Cancer Control Committees — Although there is no formal publicity planned in connection with the Co-operative Cancer Control Program, the details of organization attendant upon each of the meetings held in local communities are treated in the local papers as important news items. As a consequence each large meeting receives more publicity from local sources than it probably would receive if it were sent out directly from headquarters. The same is true of each of the small meetings held by individual groups following a large organization meeting. This is a form of spontaneous publicity and seems to be very effective.

N. Distribution of Literature and Mail

1. Literature — There were 43,232 pieces of literature distributed. The majority of these have been on cancer and the Massachusetts Cancer Program.

2. Mail — There have been 8,814 pieces of incoming mail and 46,012 pieces of outgoing mail during the year.

O. Addresses to Students in Various Institutions of Higher Learning

During the year the Director spoke before the students of the Harvard School of Public Health, Tufts College Medical School, Tufts College Dental School, Boston University Medical School, Emmanuel College, and the Boston School of Occupational Therapy. Miss Eleanor J. Macdonald spoke before the students of Tufts College Dental School and Emmanuel College.

P. Addresses Outside the State

The Director lectured on April 19th at the New England Health Institute at Hartford on "Epidemiology in Cancer."

On May 16th, the Director addressed the Eighth Pan-American Scientific Congress in Washington, D. C., on the Massachusetts Cancer Program.

The Director attended the sessions of the Seventh Health Education Institute connected with the American Public Health Association meeting held at Detroit in October and conducted a roundtable discussion.

Q. Massachusetts Cancer Deaths

The cancer deaths in Massachusetts have increased considerably over the past fifty years. In 1915 there were 1.68 times as many inhabitants in Massachusetts over the age of fifty as there were in 1890, and 2.74 times as many cancer deaths in 1915 as in 1890. In the twenty-five-year period, 1915–1940, the number of inhabitants in Massachusetts over the age of fifty increased by 1.68, the identical figure as in the preceding twenty-five-year period, but the cancer deaths only doubled — 1.99. Inasmuch as cancer is primarily a disease of late adult life, it is to be expected that the greater the number of inhabitants over the age of fifty, the greater the number of cancer deaths, other things being equal. Inasmuch as the increase of cancer deaths has been less in the second twenty-five-year period than in the first, one may assume either an improvement in the situation or that improvements in diagnosis were much greater in the first period than in the second or perhaps both.

Age, sex adjusted rates attempt to measure the death rate on the basis of a population that does not change in age and sex structure, while the crude rate merely takes into account the changing size of the population. In Table VI the female adjusted cancer rate is shown to be practically stationary until 1934. In the next five years a considerable reduction is shown, but in 1940 there is a return to the former level. This return for 1940 may well be a chance fluctuation with the 1941 returning to the lower level. On the other hand, it may be a real increase or it may be a fictitious one due to poor population estimates. The 1940 census is not available and the age divisions of the population have to be estimated from previous censuses. In the male sex there has been little change in the adjusted rate for the past eight years although yearly fluctuations are larger than among the females. While it is impossible to speak with authority with the present data, the figures indicate that the death rate for both males and females is at a maximum and any further change should be in the downward direction. The changing age at time of death of individuals dying with cancer has been upward. This is an encouraging observation.

R. Location of Cancer

The percentage distribution of cancer, by location, is shown in Table VII. Estimates of cancer incidence indicate that at any one moment there are slightly over twice as many cases as deaths during a year's period and about three and one-quarter times as many cases during a year's period as there are deaths during the same period. This applies to Massachusetts and probably to nearby states. It would not apply to the South because of the increased incidence there of skin cancer. The percentage distribution of clinic attendance is compared with that of deaths and of morbidity. The clinics have a much higher percentage of cancer of the buccal cavity and skin, much lower of the digestive tract, male genitourinary organs, and other and unspecified organs, and about the same for respiratory, uterus, other female genital organs and breast.

S. Estimated Cancer Morbidity in Massachusetts

In Table VIII is given the estimated cancer morbidity for 1939. The morbidity is obtained by multiplying the correction factors in Table VII by the deaths from each site of cancer. The correction factors were obtained by computations using the average duration of cancer compiled from the clinic figures and the generally accepted percentage of cures. The distribution, by location, used was that of the mortality record study reported by Miss Eleanor J. Macdonald in "Accuracy of the Cancer Death Records" printed in the *American Journal of Public Health*, Vol. 28, No. 7, July, 1938.

T. Cancer Control in Western Massachusetts

Cancer control in western Massachusetts has been greatly facilitated by the cancer wing in the Westfield State Sanatorium. In 1935, prior to the opening of this institution, the percentage of estimated cancer cases hospitalized was 30.3 and the percentage of cancer cases from this locality appearing at the State-aided cancer clinics was 5.1. In Table IX the estimate of the cancer population in western Massachusetts was made by the method described in discussing Table VIII. In 1939 hospitalization had increased to 37.5 per cent and clinic attendance to 14.6. The cancer population increased about 18 per cent and the individuals who were admitted to the general hospitals increased about the same, 17.9, while the Westfield admissions increased this figure to 46.4. There was a considerable decrease in attendance at other clinics besides the one at Westfield. Apparently many physicians are sending their patients to the Westfield clinic rather than to the local ones. From the standpoint of the local clinic this is not good, but from the standpoint of cancer control, the present situation is far better than in 1935.

U. Statistics of the State-aided Cancer Clinics

Table X. The number of individuals having cancer who attended the State-aided cancer clinics has shown a steady increase from 302 in 1927 to 1,806 in 1940. The percentage of individuals attending the clinics who had cancer has increased from 22.5 per cent in the first year to approximately 33.3 per cent for the last five years. A considerable part, if not all, of this change has been due to the increased number of individuals who consulted their physicians prior to attending the clinic. It is evident that many cases with no signs of malignancy have been weeded out by the profession.

Table XI. The number of individuals attending the State-aided cancer clinics in 1940 was 5,474, an increase of nearly 5 per cent over the preceding year. Cancer cases comprised 33 per cent of the total. One thousand eight hundred and six individuals were seen with cancer. These individuals had 1,905 cancers and appeared 1,884 times at the clinics.

Table XII. The attendance of new and old patients at the individual cancer clinics is shown in Table XII. Five of the clinics have a total attendance under one hundred cases. This seems rather low, but in all these five clinics the attendance of physicians at teaching clinics was good, and cancer consciousness in these communities is probably improved by the presence of the clinics.

Table XIII. The number of cities and towns from which individuals came to the cancer clinics showed a slight increase in 1940. The number of places with multiple patients has increased appreciably.

Table XIV. Reductions in the period of delay between first recognizable symptoms and first visit to a physician over a seven-year period range from no improvement in cancer of the uterus to a nearly 50 per cent improvement in cancer of other and unspecified organs. Cancer of the skin showed very little improvement. Cancer of the breast and cancer of other female genital organs showed moderate improvement, while buccal cavity, respiratory system, digestive tract, and male genitourinary organs showed a considerable improvement.

The improvement prior to clinic attendance was greatest for skin cancer, with other and unspecified organs, digestive tract, respiratory system, and buccal cavity following in that order. Cancer of the uterus, breast, and male genitourinary organs showed only a slight improvement, while cancer of other female genital organs had a slight retrogression.

It would seem that further activity should be carried on to improve cancer of all of these locations, and particularly those where therapeutic measures offer the most hope.

Table XV. The median duration of symptoms prior to first visit with a physician has shown a considerable reduction in the past five years. A similar reduction has been shown in the delay before first clinic visit.

There has been an appreciable change in the percentage distribution of location of cancer since the early days of the clinics. Adjusted durations have been computed to compensate for this. While the adjusted durations do not show quite as much improvement as the crude durations, they are sufficiently great to warrant optimism.

Table XVI. The percentages in 1940 are similar to 1939 for cancer and other conditions. Precancerous lesions, however, show a decrease in patients referred by physicians and an increase in those coming because of past experience or because of having been former patients.

Table XVII. Contact of the cancer patients with physicians was practically the same in 1940 as in 1939.

Table XVIII. The location of cancer, subdivided by the clinic's opinion as to prognosis, is shown in this table. While it is impossible to make predictions of this nature with any degree of certainty, subsequent events indicate that the surgeon's opinions are reasonably good. The percentage agreement of prognosis with end results has been shown to be accurate in approximately 75 per cent of the cases.

Table XIX. This table shows the percentage of estimated cancer cases in the State in attendance at the State-aided cancer clinics for 1932 and 1939, by location of cancer. In 1932, 4 per cent of cancers were seen by the clinics; in 1939, 7.6 per cent. Approximately one-fifth of cancers of the buccal cavity and skin are seen by the clinics, but only about one thirty-fifth of cancers of the digestive tract. There has been an increase in the percentage of cancers of all locations between 1932 and 1939.

Table XX. While approximately one-fourth of the individuals with cancer who attend the State-aided clinics are alive ten years after coming to the clinic, there is considerable variation in the percentage alive by location of the disease. Table XX shows that none of the individuals with cancer of the respiratory system were alive at the end of five years, and only a few with cancer of the digestive tract and cancer of the male genitourinary organs were alive at the end of ten years. Nearly one-half of the individuals with skin cancer were alive at the end of ten years, and those with cancer of the buccal cavity, uterus, other female genital organs, and other and unspecified organs were reasonably close to the figure for total cancer. Cancer of the breast surprisingly showed a lower percentage of individuals alive at the end of ten years than one might have expected.

Table XXI. The diagnoses of various conditions found among the patients in the clinics are shown in this table. As some individuals had more than one condition, there were more diagnoses given than the total number of patients.

Table VI. — Massachusetts Cancer Deaths

Year	Cancer Deaths in Massachusetts	Crude Cancer Death Rate per 100,000	Average Age, in Years, of Cancer Deaths	Male Age Adjusted Cancer Death Rate per 100,000	Female Age Adjusted Cancer Death Rate per 100,000
1927	5,454	132.0	62.1	92.5	128.9
1928	5,611	134.6	62.3	94.3	128.8
1929	5,672	134.7	62.4	93.3	127.4
1930	5,813	136.8	62.6	96.8	125.4
1931	5,859	137.3	62.8	93.5	126.2
1932	6,153	143.4	62.9	96.7	129.2
1933	6,382	148.1	63.1	101.5	128.7
1934	6,675	154.1	63.0	107.2	129.4
1935	6,483	149.0	63.4	99.2	125.2
1936	6,777	155.0	63.8	105.9	124.9
1937	6,831	155.6	64.1	102.8	124.5
1938	7,031	159.4	63.9	106.5	124.6
1939	7,092	160.0	64.2	104.8	124.1
1940	7,376	165.7	64.2	105.7	128.6

Table VII. — *Location of Cancer*

Rate per 100

Location of Cancer	Correction Factor for Estimating from the Deaths the Cancer Morbidity at a Given Moment of Time	Correction Factor for Estimating from the Deaths the Cancer Morbidity over One-Year Period	Percentage Distribution of Cancer Morbidity at a Given Moment of Time	Percentage Distribution of Cancer Morbidity over One-Year Period	1933 and 1934 Clinics	1935 and 1936 Clinics	1937 and 1938 Clinics	1939 and 1940 Clinics	1939 Deaths
Buccal cavity	3.18	4.43	6.3	5.5	16.4	14.0	12.8	12.8	3.3
Digestive tract	1.28	2.32	27.0	30.9	10.5	13.6	13.3	14.4	49.9
Respiratory system	1.32	2.32	1.8	2.1	2.3	3.1	2.7	2.8	5.4
Uterus	2.46	3.72	12.6	12.0	11.6	9.4	10.3	10.7	8.4
Other female genital organs	1.96	3.21	2.9	3.0	1.5	2.2	1.9	2.1	2.8
Breast	2.96	4.20	19.4	17.5	14.5	15.6	14.0	14.5	11.4
Male genito-urinary organs	1.64	2.75	6.9	7.3	3.3	3.6	3.7	4.2	8.6
Skin	15.90	22.60	12.3	11.1	34.8	32.7	35.6	30.6	1.4
Other and unspecified organs	1.93	2.98	10.8	10.6	5.1	5.8	5.7	7.9	8.8
Total	2.07	3.27	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Table VIII. — *Estimated Number of Cancer Morbidity*

Location of Cancer	Cancer Deaths of Residents of Massachusetts in 1939	Estimated Number of Cancer Cases Among Residents of Massachusetts in 1939	Estimated Number of Cancer Cases Among Residents of Massachusetts at Any One Moment in 1939
Buccal cavity	226	1,000	720
Digestive tract	3,455	8,020	4,430
Respiratory system	372	863	491
Uterus	579	2,155	1,425
Other female genital organs	195	626	382
Breast	789	3,320	2,340
Male genitourinary organs	594	1,630	975
Skin	97	2,190	1,540
Other and unspecified organs	607	1,810	1,170
Total	6,914	21,614	13,473

Table IX. — *Cancer Control in Western Massachusetts*

	1935	1939	Percentage Increase
Estimated cancer population in Western Massachusetts[2]	2,435	2,875	18.1
Individuals from Western Massachusetts with cancer admitted to the general hospitals (14)	644	759	17.9
Individuals from Western Massachusetts with cancer admitted to Pondville Hospital	93	7	
Individuals from Western Massachusetts with cancer admitted to Westfield State Sanatorium	–	313	–
Total hospitalization	737	1,079	46.4
Percentage hospitalized	30.3	37.5	–
State-aided cancer clinic attendance from Western Massachusetts (clinic at Westfield omitted)	371	166[1]	–
Clinic attendance from Western Massachusetts at Westfield clinic	–	1,146[1]	–
Total clinic attendance from Western Massachusetts	371	1,312[1]	253.6
Percentage of estimated cancer for 1940 in Western Massachusetts seen at State-aided cancer clinics	5.1	14.6	186.3

[1] 1940 figures.

[2] Berkshire, Franklin, Hampden, and Hampshire Counties.

Table X. — *The Massachusetts State-aided Cancer Clinics*

	1927	1932	1933	1934	1935	1936	1937	1938	1939	1940
Number of clinics	6	12	12	12	17	19	21	22	23	23
Total individuals attending clinics	1,345	3,505	3,926	4,252	3,736	3,953	4,098	4,978	5,257	5,474
Total individuals having cancer	302	894	1,016	1,054	1,077	1,298	1,366	1,712	1,753	1,806
Total individuals having precancerous lesions	109	374	514	619	376	419	374	376	354	356
Percentage of individuals with cancer	22.5	25.5	25.9	24.8	28.8	32.8	33.3	34.4	33.3	33.0
Percentage of individuals with precancerous lesions	8.1	10.7	13.1	14.6	10.1	10.6	9.1	7.6	6.7	6.5
Median age, in years, of cancer patients	60.5	60.6	61.0	62.4	62.9	63.2	62.6	62.6	62.6	63.1

Table XI. — *Attendance at State-aided Cancer Clinics, 1940*

Total individuals attending clinics	5,474
Total individuals having cancer	1,806
Total individuals having precancerous lesions	356
Total individuals having postoperative cancer, no evidence of recurrence	252
Total attendance at clinics	5,616
Total cancer attendance at clinics	1,884
Total precancer attendance at clinics	321
Total postoperative cancer, no evidence of recurrence, attendance at clinics	259
Total diagnoses	5,663
Total cancer diagnoses	1,905
Total precancer diagnoses	363
Total postoperative cancer, no evidence of recurrence, diagnoses	261
Percentage of individuals with cancer	33.0
Percentage of individuals with precancerous lesions	6.5
Median age of total clinic patients	54.5
Median age of cancer patients	63.1

Table XII. — *Clinic Attendance, 1940, by Individual Clinic*

Clinic	Attendance New Patients[1]	Attendance Old Patients	Total Attendance	Attendance New Cancer Patients	Attendance of Physicians at Teaching Clinics	Percentage Cancer
Beth Israel	250	1,667	1,917	103	0	41.2
Beverly	136	184	320	32	0	23.5
Boston Dispensary	448	2,140	2,588	118	93	26.3
Brockton	131	108	239	53	111	40.5
Fall River	188	585	773	52	147	27.7
Fitchburg	53	123	176	18	101	34.0
Gardner	68	88	156	12	98	17.6
Gloucester	49	59	108	8	65	16.3
Greenfield	31	52	83	6	30	19.4
Hyannis	35	71	106	19	55	54.3
Lawrence	95	96	191	43	84	45.3
Lowell	208	166	374	43	15	20.7
Lynn	282	566	848	103	70	36.5
New Bedford	209	340	549	60	24	28.7
Newburyport	30	43	73	16	58	53.3
North Adams	12	40	52	3	26	25.0
Pittsfield	13	41	54	2	42	15.4
Pondville	1,509	6,218	7,727	563	0	37.3
Quincy	30	39	69	15	55	50.0
Salem	190	276	466	70	136	36.8
Springfield	107	96	203	26	0	24.3
Westfield	1,228	5,091	6,319	441	173	35.9
Worcester	314	767	1,081	78	72	24.8
Total	5,616	18,856	24,472	1,884	1,455	33.5

[1] Some individuals went to more than one clinic.

Table XIII. — *Residents of Massachusetts Cities and Towns Attending State-aided Cancer Clinics*

	1939	1940
Number of places with 1 patient	59	47
Number of places with 2–5 patients	87	101
Number of places with 6–9 patients	49	47
Number of places with 10 patients and over	93	98
Total number of places	288	293

Table XIV. — *Median Duration, in Months, by Location of Cancer, and Percentage Reduction in Delay over Seven-Year Period between First Symptom and First Visit to Physician and First Visit to Clinic*

Location of Cancer	1940 Period of Delay before First Visit to Physician	Reduction in Duration of Delay before First Visit to Physician	1940 Period of Delay before First Visit to Clinic	Reduction in Duration of Delay before First Visit to Clinic
Buccal cavity	3.6	27.0	4.8	17.3
Digestive tract	2.9	28.4	6.2	28.8
Respiratory system	3.1	23.6	6.6	22.2
Uterus	2.9	0.0	6.2	5.1
Other female genital organs	5.8	11.8	8.2	—1.1
Breast	4.5	11.2	6.2	3.4
Male genitourinary organs	3.2	30.2	7.8	4.5
Skin	12.2	1.6	12.7	56.4
Other and unspecified organs	3.0	47.6	5.9	30.4
Total	4.6	23.1	6.9	25.6

Table XV. — *Median Durations*

Year	Median Delay, in Months, between First Symptoms and Visit to Physician		Median Delay, in Months, between First Symptoms and Visit to Clinic	
	Crude Median Duration	Adjusted Median Duration	Crude Median Duration	Adjusted Median Duration
1931 . . .	6.7	6.2	12.2	11.0
1932 . . .	6.2	5.0	9.3	8.8
1933 . . .	6.1	5.2	9.4	8.5
1934 . . .	6.2	5.0	9.0	8.2
1935 . . .	6.2	5.2	9.3	8.6
1936 . . .	5.3	4.9	8.3	7.3
1937 . . .	5.7	4.7	8.7	7.8
1938 . . .	5.0	4.6	8.0	8.1
1939 . . .	5.0	4.4	8.1	7.4
1940 . . .	4.6	4.4	6.9	7.0

Table XVI. — *Reason for Coming to Clinic, by Diagnosis*

Rate per 100*

Reason	Cancer		Precancerous Lesions		All Others		Total	
	1939	1940	1939	1940	1939	1940	1939	1940
Physician . . .	85.8	86.4	70.1	60.3	78.8	79.9	80.5	80.8
Past experience or former patient . .	7.8	10.5	21.1	30.0	6.9	8.6	8.1	10.6
Newspaper . . .	0.7	0.6	1.7	1.9	3.4	2.2	2.4	1.6
Friend or relative .	2.5	1.2	2.6	3.3	3.8	3.8	3.3	2.9
Social worker or nurse .	1.8	1.8	2.8	4.7	4.0	3.5	3.2	3.0
All others . . .	2.2	0.6	4.3	1.1	3.8	2.5	3.3	1.8

* Does not total 100 per cent as some individuals gave more than one reason.

Table XVII. — *Contact of Cancer Patients with Physician*

Rate per 100

	1939	1940
Referred by physician:		
One physician consulted	44.2	45.0
More than one physician consulted	40.8	39.7
Unknown	0.8	1.7
Not referred by physician:		
One or more physicians consulted	7.1	6.5
No physician consulted	6.8	7.0
Unknown	0.3	0.1

Table XVIII. — *Operability of Cancer, by Location of Cancer and Sex*

Rate per 100

Location of Cancer	Operable Cancer Probable Cure 1939	Operable Cancer Probable Cure 1940	Operable Cancer Possible Cure 1939	Operable Cancer Possible Cure 1940	Operable Cancer Palliative Measures Only 1939	Operable Cancer Palliative Measures Only 1940	Inoperable Cancer 1939	Inoperable Cancer 1940
MALES								
Buccal cavity	45.4	37.3	32.0	44.3	22.2	12.3	0.5	6.1
Digestive tract	4.1	4.3	39.2	33.5	39.9	34.2	16.9	28.0
Respiratory system	0.0	2.1	24.4	25.5	58.5	57.4	17.1	14.9
Male genitourinary organs	4.9	4.5	32.1	41.8	49.4	38.8	13.6	14.9
Skin	78.5	70.2	20.2	23.5	1.2	6.3	0.0	0.0
Other and unspecified organs	6.2	16.5	31.3	23.5	46.9	43.5	15.6	16.5
Total	41.4	38.4	28.7	31.3	23.6	20.8	6.3	9.5
FEMALES								
Buccal cavity	16.7	17.4	50.0	30.4	33.3	34.8	0.0	17.4
Digestive tract	3.5	5.9	33.7	32.4	38.4	32.4	24.4	29.4
Respiratory system	0.0	0.0	33.3	0.0	50.0	40.0	16.7	60.0
Uterus	9.4	8.2	51.9	56.9	35.9	28.2	2.8	6.7
Other female genital organs	8.3	12.8	36.1	30.8	44.4	43.6	11.1	12.8
Breast	13.0	15.8	44.7	41.9	38.2	33.5	4.1	8.8
Skin	74.1	76.6	22.8	21.1	2.6	2.4	0.5	0.0
Other and unspecified organs	8.6	10.0	27.6	31.4	58.6	50.0	5.2	8.6
Total	24.7	26.5	38.6	37.4	31.2	26.8	5.4	9.3

Table XIX. — *Percentage of Estimated Cancer Cases in State in Attendance at the State-aided Cancer Clinics, by Location of Cancer*

Location of Cancer	1932	1939
Buccal cavity	12.3	21.3
Digestive tract	1.7	2.9
Respiratory system	1.3	5.4
Uterus	3.1	8.2
Other female genital organs	3.1	5.7
Breast	4.7	7.5
Male genitourinary organs	2.0	4.8
Skin	10.2	22.5
Other and unspecified organs	3.1	6.6
Total	4.0	7.6

Table XX. — *Percentage of Patients with Cancer Attending State-aided Cancer Clinics in 1927–1929 Alive Five and Ten Years after Clinic Admission, by Location of Cancer*

Location of Cancer	Total Cancer 1927–1929	Percentage Alive Five Years After Coming to Clinic	Percentage Alive Ten Years After Coming to Clinic
Buccal cavity	236	37.3	23.3
Digestive tract	110	5.5	4.6
Respiratory system	17	0.0	0.0
Uterus	139	31.6	21.6
Other female genital organs	22	36.4	27.2
Breast	224	29.4	15.6
Male genitourinary organs	25	16.0	4.0
Skin	461	71.2	47.0
Other and unspecified organs	63	31.8	23.8
Total	1,297	38.6	26.2

Table XXI. — *Diagnosis*

Rate per 100*

Diagnosis	1939	1940
Cancer primary	21.74	22.18
Cancer with metastases	7.17	8.31
Cancer recurrent following operation	2.77	2.69
Original diagnosis noncancer, changed to cancer	0.36	0.37
Original diagnosis postoperative cancer, changed to cancer recurrent	0.04	0.09
Original diagnosis precancerous lesions, changed to cancer	0.11	0.02
Diagnosed cancer at death	0.13	0.18
Original diagnosis postoperative cancer, changed to cancer recurrent of same site at death	0.02	0.02
Original diagnosis noncancer, changed to cancer of same site at death	0.02	0.05
Original diagnosis Hodgkin's disease, changed to cancer	0.00	0.04
Hodgkin's disease and leukemia	0.92	0.86
Postoperative cancer, no evidence of recurrence	4.19	4.73
Original diagnosis cancer recurrent, changed to postoperative cancer	0.02	0.02
Original diagnosis postoperative cancer, diagnosed cancer of another site at death	0.00	0.02
Benign tumors	11.63	11.55
Precancerous lesions	6.67	6.59
Original diagnosis cancer, changed to precancerous lesions	0.04	0.04
Original diagnosis cancer, changed to noncancer	0.86	0.58
Diseases of the digestive system	6.02	8.93
Diseases of the circulatory system	1.32	1.00
Diseases of the genitourinary system	11.97	9.57
Diseases of the respiratory system	0.38	0.33
Diseases of the nervous system	0.52	0.37
Diseases of the skin	5.35	5.39
Mouth lesions	2.37	2.21
Diseases of the bone	0.54	0.33
Diseases of the eye and ear	0.15	0.13
Tuberculosis	0.63	0.69
Diabetes	0.15	0.09
Pernicious anemia	0.11	0.07
Rheumatism	0.46	0.16
Goiter	0.17	0.24
Syphilis	0.31	0.22
Endocrine dysfunction	0.11	0.62
Undiagnosed	1.13	3.12
Deferred	5.34	2.43
No pathology	4.19	2.87
Noncancer, diagnosis not established	3.02	3.73
All others	2.41	2.61

Postoperative cancer means postoperative cancer with no evidence of recurrence.

* Does not total 100 per cent as some individuals had more than one diagnosis.

Table XXII. — *Tumor Diagnosis Service, 1940*

Specimens were received from hospitals listed below:

Acushnet Sanitarium and Hospital, New Bedford
Addison Gilbert Hospital, Gloucester
Amesbury Hospital, Amesbury
Amherst Student Health Office, Amherst
Anna Jaques Hospital, Newburyport
Audubon Hospital, Boston

Baker Clinic, Boston
Bay State Hospital, Boston
Belchertown State School, Belchertown
Bellevue Hospital, Brookline
Benson Clinic, Haverhill
Benson Hospital, Haverhill
Bessie Burke Memorial Hospital, Lawrence
Boston Evening Clinic, Boston
Bow Street Clinic, Somerville
Bridgewater State Hospital, State Farm
Brockton Hospital, Brockton
Burbank Hospital, Fitchburg

Cape Cod Hospital, Hyannis
Central Hospital, Somerville
Charlesgate Hospital, Cambridge
Chester Hospital, Cambridge
Choate Memorial Hospital, Woburn
Claflin Hill Hospital, Milford
Clover Hill Hospital, Lawrence
Community Memorial Hospital, Ayer
Cooley Dickinson Hospital, Northampton
Corey Hill Hospital, Brookline
Crocker Hospital, East Pepperell

Dover Street Clinic, Boston
Ducy Hospital, Brockton

Elmhurst Hospital, Weymouth
Emerson Hospital, Forest Hills

Fairlawn Hospital, Worcester
Faulkner Hospital, Jamaica Plain
Forest Hills Hospital, Jamaica Plain
Franklin County Public Hospital, Greenfield
Furcolo Clinic, Springfield

Gardner State Colony, Gardner
General Electric Hospital, Pittsfield
Glover Memorial Hospital, Needham
Glynn Hospital, Dorchester
Goddard Hospital, Brockton
Groton Hospital, Groton

Hahnemann Hospital, Worcester
Hale Hospital, Haverhill
Harvard Hospital, Worcester
Haverhill Municipal Hospital, Haverhill
Henry Heywood Memorial Hospital, Gardner
Hillcrest Hospital, Pittsfield
Holden District Hospital, Holden
Holyoke Hospital, Holyoke
Homberg Infirmary, Cambridge
House of Mercy Hospital, Pittsfield
Hull Hospital, Hull
Hunt Memorial Hospital, Danvers
Huntington Memorial Hospital, Boston

Irving Hospital, Framingham
Isolation Hospital, Lowell

Jewish Memorial Hospital, Roxbury
Jordan Hospital, Plymouth

Kenmore Memorial Hospital, Boston

Lawrence Clinic, Lawrence
Leominster Hospital, Leominster
Lincoln Hospital, Worcester
Lowell General Hospital, Lowell
Ludlow Hospital, Ludlow
Lynn Hospital, Lynn

MacLeod Hospital, Boston
Malden Hospital, Malden
Maplewood Hospital, Malden
Marlborough Hospital, Marlborough
Mary Alley Hospital, Marblehead
Mary Lane Hospital, Ware
Mary E. McGowan Memorial Hospital, Methuen
Massachusetts Hospital School, Canton
Massachusetts Osteopathic Hospital, Jamaica Plain
Maverick Dispensary, East Boston
Medfield State Hospital, Harding
Melrose Hospital, Melrose
Mercy Hospital, Springfield
Millers River Hospital, Winchendon
Milton Hospital, Milton
Moore Hospital, Brockton
Morton Hospital, Taunton
Mount Hope Hospital, North Dighton

Nantucket Cottage Hospital, Nantucket
New England Sanitarium and Hospital, Melrose
Noble Hospital, Westfield
Northampton State Hospital, Northampton
Norwood Hospital, Norwood

Phaneuf Hospital, Brockton
Plymouth County Hospital, South Hanson
Providence Hospital, Holyoke

Quincy City Hospital, Quincy

Saint Anne's Hospital, Fall River
Saint Elizabeth's Hospital, Brighton
Saint Luke's Hospital, Middleborough
Saint Luke's Hospital, New Bedford
Somerville Hospital, Somerville
Springfield Hospital Cancer Clinic, Springfield
State Prison Colony Hospital, Norfolk
Strong Hospital, East Boston
Sturdy Memorial Hospital, Attleboro
Sunnyside Hospital, Somerville

Tobey Hospital, Wareham
Trumbull Hospital, Brookline

Union Hospital, Lynn
Union Hospital, New Bedford
United States Marine Hospital, Chelsea

Vincent Memorial Hospital, Jamaica Plain

Wesson Memorial Hospital, Springfield
Whitinsville Hospital, Whitinsville
Winthrop Community Hospital, Winthrop
Wing Memorial Hospital, Palmer

Table XXIII. — *Tumor Diagnosis Service, 1940*

City or Town	Number of Doctors Sending in Specimens
Abington	1
Acushnet	2
Amesbury	7
Andover	1
Ashburnham	1
Athol	5
Attleboro	6
Ayer	1
Barnstable	5
Belchertown	1
Belmont	2
Beverly	2
Boston	147
Bourne	1
Braintree	1
Bridgewater	6
Brockton	12
Brookline	4
Cambridge	11
Canton	4
Chatham	1
Chelsea	5
Chester	1
Chicopee	2
Clinton	2
Colrain	1
Conway	1
Danvers	4
Dedham	2
Douglas	1
Duxbury	1
Easton	2
Everett	3
Fall River	3
Fitchburg	6
Foxborough	2
Framingham	4
Gardner	17
Gloucester	5
Great Barrington	2
Greenfield	6
Groton	4
Groveland	1
Hardwick	1
Harwich	1
Haverhill	15
Hinsdale	1
Holbrook	2
Holden	3
Holyoke	17
Hudson	3
Hull	1
Huntington	1
Kingston	2
Lawrence	49
Leicester	1
Leominster	8
Lexington	1
Lowell	7
Ludlow	3
Lynn	31
Malden	4
Manchester	1
Mansfield	3
Marblehead	2
Marion	1
Marshfield	1
Medfield	2
Medford	3
Melrose	3
Merrimac	2
Methuen	2
Middleborough	1
Milford	1
Milton	7
Monson	2
Montague	1
Nantucket	4
Needham	4
New Bedford	26
Newbury	1
Newburyport	6
Newton	5
Norfolk	4
North Adams	1
North Andover	1
North Attleborough	1
North Reading	1
Northampton	5
Northbridge	1
Norton	1
Norwell	1
Norwood	9
Oak Bluffs	1
Orange	1
Palmer	5
Peabody	9
Pepperell	1
Pittsfield	23
Plymouth	9
Provincetown	1
Quincy	9
Randolph	2
Reading	1
Revere	3
Rockland	1
Rockport	1
Russell	1
Salem	4
Saugus	5
Seekonk	1
Sharon	1
Shelburne	3
Shrewsbury	1
Somerville	38
South Hadley	1
Southwick	1
Springfield	30
Stoneham	3
Stoughton	2
Sudbury	1
Swampscott	2
Taunton	13
Topsfield	1
Uxbridge	1
Wakefield	4
Walpole	2
Waltham	4
Ware	5
Wareham	3
Warren	2
Watertown	3
Wayland	1
Webster	1
West Newbury	1
West Springfield	1
Westfield	9
Westford	1
Weymouth	4
Wilmington	1
Winchendon	5
Winthrop	2
Woburn	5
Worcester	18
Total	798

REPORT OF DIVISION OF BIOLOGIC LABORATORIES

Elliott S. Robinson, M.D., Ph.D., *Director*

I. Antitoxin and Vaccine Laboratory

1. General

The pneumonia control program has previously provided serums for Types 1, 2, 5, 7, 8 and 14. This list was extended during the 1939–1940 season by making serums for Types 4, 9 and 18 available for any cases in which these types are demonstrated in the sputum or blood culture; and for the remaining types if the patient has a positive blood or spinal fluid culture. The general use of chemotherapy (sulfapyridine and later sulfathiazole) has tended to restrict the use of serum to the more severe cases and to those which do not respond promptly to drug treatment. It is felt that serum still has a definite field of usefulness, despite the proved efficacy of sulfapyridine and sulfathiazole. The introduction of chemotherapy necessitated a revision of the circular describing serum treatment and the preparation of a circular outlining the use of specific drugs. The latter has been recently revised and is now being printed.

The typhoid-paratyphoid B vaccine has been replaced for general use by a monovalent typhoid vaccine. The lower prevalence of paratyphoid B infections made this change seem desirable.

2. Distribution of Products

Diphtheria	*1936*	*1937*	*1938*	*1939*	*1940*
Antitoxin, 1,000 unit doses	78,222	63,769	56,503	49,538	48,744
Schick Outfits, 50 doses each	5,109	4,905	4,033	3,928	4,136
Toxin-Antitoxin Mixture, 1 cc. doses	148,372	61,530	43,531	43,751	48,945
Toxoid, 1 cc. doses	218,857	274,759	283,139	262,170	251,704
Toxin (Bulk), cc.	300	580	1,070	1,885	1,780
Scarlet Fever					
S. F. Streptococcus Antitoxin, doses	1,873	1,893	1,737	1,823	1,405
S. F. Streptococcus Toxin, 5 cc. vials	805	636	554	610	391
S. F. Streptococcus Toxin, Heated Control, 5 cc. vials	568	447	386	495	395
S. F. Streptococcus Toxoid, 1 cc. doses	35,706	25,361	16,121	16,827	11,299
Pneumonia					
Antipneumococcic Serum, horse, conc. vials	3,438	5,800	6,707	6,651	4,037
Antipneumococcic Serum, horse (Bulk), cc.	2,000	200	4,427	700	11,550
Antipneumococcic Serum, rabbit, vials	–	–	–	193*	1,266†
Diagnostic Serums (of rabbit origin, unless otherwise noted)					
Pneumococcus Type 1 — horse, cc.	140	235	105	105	15
Pneumococcus Type 2 — horse, cc.	310	245	80	70	10
Pneumococcus Type 3 — horse, cc.	140	230	55	55	15
Pneumococcus Type 1 — cc.	246	300	335	237	171
Pneumococcus Type 2, cc.	244	288	271	218	154
Pneumococcus Type 3, cc.	132	276	292	231	162
Pneumococcus Type 4, cc.	–	–	–	35	108
Pneumococcus Type 5, cc.	70	170	264	166	134
Pneumococcus Type 7, cc.	3	134	260	168	142
Pneumococcus Type 8, cc.	48	162	281	190	143
Pneumococcus Type 14, cc.	–	–	–	106	138
Pneumococcus, other types	–	–	–	453	791‡
Pneumococcus, Pool A, cc.	–	–	–	256	291
Pneumococcus, Pool B, cc.	–	–	–	260	295
Pneumococcus, Pool C, cc.	–	–	–	217	290
Pneumococcus, Pool D, cc.	–	–	–	206	279
Pneumococcus, Pool E, cc.	–	–	–	201	285
Pneumococcus, Pool F, cc.	–	–	–	205	277
Measles					
Placental Extract, vials	5,114	2,163	1,304	3,299	3,248
Sodium Citrate Solution, vials	1,246	943	713	535	725
Meningitis					
Antimeningococcic Serum, 15 cc. doses	4,670	3,339	1,781	1,888	2,201
Antimeningococcic Serum, Conc., 15 cc. doses	–	87	2	24	20
Influenze (Pfeiffer Bacillus) Antiserum, vials	1,148	2,118	2,488	2,796	2,562
Influenza (Pfeiffer Bacillus) Antiserum, Bulk, cc.	–	100	–	–	1,200

* Type 14.

† 15 vials Type 17; 16 vials Type 23; 20 vials each Types 20, 21, 24, 28, 31 and 32; 21 vials each Types 22 and 29; 23 vials Type 16; 24 vials Type 15; 25 vials each Types 10, 11 and 25; 30 vials Type 12; 34 vials Type 6; 35 vials Type 13; 36 vials Type 27; 37 vials Type 19; 120 vials Type 9; 123 vials Type 18; 155 vials Type 3; 176 vials Type 14 and 205 vials Type 4.

‡ 24 vials each Types 12, 23, 27, 31 and 32; 25 vials Types 15 and 25; 26 vials each Types 13, 16 and 22; 27 vials each Types 11, 20, 28 and 29; 28 vials each Types 10, 17 and 19; 29 vials each Types 21 and 24; 44 vials Type 6; 69 vials Type 33; 90 vials each Types 9 and 18.

	1936	1937	1938	1939	1940
Miscellaneous Serums					
Horse Serum, Normal, cc.	58,830	87,585	64,600	135,010	173,980
Enteric Fevers					
Typhoid Vaccine, cc.	–	54,471	–	–	54,926
Typhoid-Paratyphoid B vaccine, cc.	–	15,935	107,426	116,326	45,100
Other Products					
Smallpox Vaccine, capillary tubes	231,602	244,329	221,576	221,746	233,364
Tuberculin, ampoules — 0.7 cc.	4,265	1,826*	1,821†	1,812	1,769
Tuberculin, capillary tubes	–	11,625	12,730	9,185	12,045
Silver Nitrate Solution, ampoules	65,493	76,340	77,488	79,076	83,324
Serum Sensitivity Outfits	32	646	947	1,004	1,197
Trichina Antigen, ampoules	–	–	–	–	143
Syphilis (See also table in report of Division of Genitoinfectious Diseases)					
Arsphenamine, 0.4, 0.6 and 3.0 gm. ampoules	3,605	3,656	2,625	2,450	2,308
Sulpharsphenamine, 0.3, 0.4 [1], 0.6, 1.0 [2] and 3.0 gm. ampoules	5,583	6,156	4,329	3,533	3,542
Neoarsphenamine, 0.3 [3], 0.45, 0.6, 0.9 gm. ampoules	68,449	70,071	67,047	63,490	48,339
Mapharsen, 0.04, 0.06, 0.4 [4], and 0.6 [4] gm. ampoules	2,625	10,855	13,280	21,835	37,465
Bismuth Salicylate in oil, 10 cc. bottles [3] and 2 oz. bottles	947	3,062	5,444	6,663	6,431

Products not distributed in 1940
Scarlet Fever Convalescent Serum — 101 vials in 1936; 56 in 1937 and 3 in 1938
Scarlet Fever Streptococcus Toxin for immunization — 240–1 cc. doses in 1936; 105 in 1937 and 580 in 1938
Diagnostic Pneumococcus Type 5 Horse Serum — 25 cc. in 1936 and 15 cc. in 1937
Pneumococcus Vaccine, Type 2 — 86–20 cc. vials in 1936; Type 7 — 150 cc. in 1938
Typhus Serum — 21–20 cc. vials in 1936 and 1,194 in 1937
Typhus Serum — 4,000 cc. in bulk in 1936, 230 cc. in 1937 and 1,000 cc. in 1939
Mumps Convalescent Serum — 110 cc. in 1939
Poliomyelitis Convalescent Serum — 556 vials in 1936; 633 in 1937 and 75 in 1938
Flexner Dysentery Vaccine (dried) capsules — 6,130 in 1936
Typhoid-H antigen — 11–5 cc. vials in 1936
Typhoid-Paratyphoid A and B vaccine — 188,118 cc. in 1936 and 116,743 cc. in 1937
Diagnostic Typhoid Serum — 12 cc. in 1936 and 12 cc. in 1937
Diagnostic Paratyphoid A Serum — 5 cc. in 1936 and 17½ cc. in 1937
Diagnostic Paratyphoid B Serum — 5 cc. in 1936 and 17½ cc. in 1937

* Of these ampoules 68 contained 204 cc. in all and 1,758 contained 0.7 cc. each.

† Of these ampoules 15 contained 5 cc. each and 1,806 contained 0.7 cc. each.

[1] Discontinued in 1936.

[2] Discontinued in 1937.

[3] Begun in 1937.

[4] Begun in 1939.

a. Scarlet Fever Products. The distribution of antitoxin is at the lowest level since distribution of this product was resumed in 1933. The immunization program, using toxoid, required smaller amounts of material than previously.

b. Antipneumococcic Serums — Therapeutic. The increasing use of specific chemotherapy tended to lessen the demand for serum. The distribution of horse serums of Types 1, 2, 5, 7 and 8 is about 60 per cent of the 1939 figure. Distribution of purchased rabbit serum has increased because of the greater number of types now distributed.

	Type 1 Units	Type 2 Units	Type 5 Units	Type 7 Units	Type 8 Units	Type 14 Units*
1936	88,540,000	51,942,500	–	–	–	–
1937	121,060,000	75,880,000	15,139,500	–	–	–
1938	85,550,000	36,524,000	27,384,500	32,280,000	5,640,000	–
1939	85,150,000	35,590,000	28,197,500	38,213,500	28,367,500	3,860,000
1940	54,420,000	27,025,000	22,320,000	23,840,000	22,640,000	3,520,000

* Purchased.

Other types were not distributed prior to 1940 and, therefore, are not given in this table.

c. Anti-Influenza Bacillus Serum. For the first time in several years the distribution has fallen below the level of the preceding year. This is perhaps partly due to a developing interest in rabbit antiserum, the manufacture of which we have not yet undertaken.

d. Silver Nitrate Ampoules. The distribution of these continues to rise, being now about 40 per cent larger than the figure of five years ago, with a steady increase during the entire period.

e. Trichina Antigen. This is furnished us by the U. S. Public Health Service, for distribution to interested physicians.

3. Expenses

Year	Personal Services		Expenses		Total	
	Appropriation	Spent	Appropriation	Spent	Appropriation	Spent
1936 . . .	$77,680.00	$77,416.32	$36,500.00	$35,441.04	$114,180.00	$112,857.36
1937 . . .	80,000.00	77,339.61	36,813.62	34,423.30	116,813.62	111,762.91
1938 . . .	79,350.00	75,821.49	34,570.21	33,474.83	113,920.21	109,296.32
1939 . . .	79,300.00	77,524.02	34,496.14	33,561.18	113,796.14	111,085.20
1940 . . .	81,700.00	77,323.60	34,628.50	33,169.78	116,328.50	110,493.38

4. Improvements

The installation of a freight elevator in the stable has greatly increased the safety and ease of moving bales of shavings, etc. Our boiler for high-pressure steam for sterilizers, etc., was replaced. No other major changes have been made.

5. Educational Activities

One bacteriologist from the Porto Rican Health Department has been given training for three months to enable her to initiate the manufacture of certain biologic products in Porto Rico. In addition, demonstrations at the laboratory were given for 13 groups of students totalling 407 individuals. Three addresses were made away from the laboratory by the Director and staff before a total of 290 persons. Laboratory workers from Argentina, Canada, China, Costa Rica, India, Lithuania, the Netherlands, Porto Rico, Siam and Venezuela visited the laboratory. Two students from Simmons College were also accepted for special laboratory training.

6. Investigations

(*a*) Diphtheria toxin production has been so improved that the potency has been very greatly increased. The newer methods are somewhat more laborious than the older ones, but the improvement in the product makes this worth while. This work has been done with the cooperation of the Department of Bacteriology, Harvard Medical School.

(*b*) The study of immunization against scarlet fever by means of toxoid is still under way. This work, done in cooperation with the Division of Communicable Diseases, is described in the report of that division.

(*c*) The problem of chill and thermal reactions following the injection of antipneumococcic serum is apparently on the way to solution. Figures on the more recent lots are not completely compiled, but so far suggest that the incidence of reactions is lower than in previous years.

(*d*) Further work in cooperation with the Department of Physical Chemistry, Harvard Medical School, on the proteins of antipneumococcic serum has been done. This problem is of value in improving the methods of concentration.

(*e*) The development of methods to use in the approval of laboratories, the inspections required, and the review of the performance reports has taken a good deal of time. It is listed under the heading of investigations because it has necessitated the development of evaluation methods in the field of bacteriological diagnosis. Details of the results will be found in the report of the Division of Communicable Diseases (p. 72) and of the Wassermann Laboratory (p. 54).

7. Projected Activities

No new products are contemplated at present, with the exception of human plasma for transfusion. The local chapter of the American Red Cross is discussing plans for securing blood from donors, and it is possible that this laboratory may share in the project. The plans are in such an early stage of development that no further discussion of them seems desirable.

The routine activities and the problems under investigation will be continued as described above.

II. Wassermann Laboratory

William A. Hinton, M.D., *Chief of Laboratory*

1. *Routine Tests*

The steady increase in the number of tests performed continues, as indicated in the table. The number of Hinton tests has risen about 25 per cent over the previous year. It would seem that this rate of increase should show signs of slowing down, but review of the figures of recent years does not suggest that that time is near at hand. Furthermore, the physical examinations under the Selective Service Act require a serological test for syphilis, and these are being performed at this laboratory. This new project will probably add at least 50,000 tests a year, possibly many more.

1. *Tests and Examinations*

Kind of Specimen		1937	1938	1939	1940
Blood	Number of Specimens	215,293	254,195	295,114	360,401
	Tests				
	Hinton	186,387	223,210	255,589	322,797
	Wassermann	8,912	6,173	–	–
	Davies Micro-Hinton	1,659	3,207	4,072	4,662
	Bacillus Abortus Agglutination*	25,431	27,184	29,787	30,380
	G.C. Compl. Fixation	9,196	10,396	11,101	9,146
	Glanders*	39	24	37	22
Spinal Fluid	Number of Specimens	8,910	9,740	10,430	11,784
	Tests				
	Wassermann	8,911	9,740	10,435	11,784
	Davies-Hinton	835	3,865	5,097	6,154
	Gold Sol	546	500	–	–
Rabies Diagnosis*	Number of Specimens	460	295	302	306
	Tests				
	Impressions	460	295	302	306
	Sections	455	289	296	298
	Animal Inoculation	275	230	248	240
Path. and Bact. Examinations*	Number of Specimens	7	7	10	5
	Tests				
	Sections	2	4	4	0
	Animal Inoculation	5	2	7	1
	Cultures	1	1	5	4
	Smears	0	2	1	2
	Total Tests	243,114	285,122	316,981	385,796
	Total Specimens	224,670	264,237	305,856	372,496

* Diagnostic Examinations for Division of Livestock Disease Control.

2. *Expenses*

Year	Personal Services		Expenses		Total	
	Appropriation	Spent	Appropriation	Spent	Appropriation	Spent
1936	$18,110.00	$18,015.58	$5,800.00	$5,502.30	$23,910.00	$23,517.88
1937	18,700.00	18,549.68	6,000.00	6,012.02	24,700.00	24,561.70
1938	19,000.00	18,973.81	6,000.00	5,992.43	25,000.00	24,966.24
1939	19,300.00	17,093.21	6,200.00	6,177.46	25,500.00	23,270.67
1940	19,650.00	19,085.07	6,322.98	5,956.85	25,972.98	25,041.93

3. Education

Additional routine activities included laboratory demonstrations and instruction to: graduate and senior students from Simmons College and students from the second year class of the Harvard Medical School.

4. Investigations

Work on the serology of syphilis in rabbits treated with arsphenamine has continued throughout the year.

The appointment of an additional Senior Bacteriologist has made possible the resumption of work on serologic detection of gonococcal infections.

5. Evaluation of Laboratories

The evaluation of laboratories in Massachusetts to determine their efficiency in the serologic detection of syphilis was carried out in compliance with recently enacted laws. Thirty-one institutions have been approved for testing blood of blood donors and ten institutions have been approved for routine serologic tests for syphilis. Six technicians from hospitals in Massachusetts have been instructed in the technic of the Rapid Hinton test.

6. New and Proposed Activities

(*a*) Serologic tests for syphilis are being done on the members of the National Guard, prior to their induction into the Army. This has been begun only recently, and already 8,074 of the approximately 9,000 men have been tested.

(*b*) Serologic tests for syphilis are also being performed for the Selective Service Boards. As mentioned above, this will mean many thousand tests each year when the military training program is really under way. Because of the use of special report forms, these tests have so far taken somewhat more time than routine specimens. 9,637 of these tests have been performed.

(*c*) Evaluation of laboratories performing serologic tests for syphilis will be continued by submitting specimens to those whose applications are still pending and by sending additional specimens from time to time to those already approved in order to check the level of their performance.

(*d*) The studies mentioned in Section 4 will be continued.

REPORT OF THE DIVISION OF CHILD HYGIENE

M. Luise Diez, M.D., *Director*

The activities of the Division of Child Hygiene during the year ending December 31, 1940, were chiefly the following:

I. Activities of the Various Sections:

1. Maternal, Infant and Preschool Hygiene:

(*a*) *Maternity Service:*

In the field of maternity, infancy and child hygiene the usual program was carried on during the year. The demand for the monthly prenatal and postnatal letters, providing instruction for prospective mothers and mothers of children under two years of age, was sustained throughout the year. New requests for prenatal letters during the year 1940 totalled 8,409; the letter to fathers was sent to 8,409 fathers; there were new requests for the first year postnatal letters totalling 9,164; and at the close of the year there were on the registry to receive the postnatal letters for the second year a total of 14,701 mothers' names. The total number of mothers registered for this monthly letter service was approximately 31,210.

Cooperating with the Reformatory for Women at Framingham, the public health nursing supervisors of the Division assisted in the follow-up of mothers and babies who had been discharged from that institution during the year. Local nurses were called upon for this service wherever they were available for home visiting. A total of 12 such cases were referred to the Division of Child Hygiene for follow-up during the year.

(*b*) *Mothers' Classes:*

The outline for mothers' classes, entitled "Guide for Mothers' Discussion Group Meetings," was in demand throughout the year. The public health nursing supervisors stimulated this activity in the communities within their districts through the local nurses and nursing organizations. Instruction in maternal and child care was given through these classes to the 792 mothers who enrolled, in 16 communities.

(*c*) *Prenatal Clinics:*

The first prenatal clinic to be started under the supervision of the Division of Child Hygiene was organized in Westfield, the physicians conducting the clinic being paid through this Division, from federal funds. The nursing organization was carried on by the district supervisory nurses of this Division. The clinic is held in the Board of Health office but is affiliated with the Noble Hospital.

Visits to local prenatal clinics were continued by one of the child welfare physicians and the public health nursing supervisors of the Division. Nutrition instruction of nurses and dietitians in these local prenatal clinics was continued through the Division nutritionists.

Mimeographed material entitled "Organization and Conduct of Community Prenatal and Postnatal Clinics," and the Children's Bureau publication entitled "Standards of Prenatal Care," were sent to all prenatal clinics in the State. The latter pamphlet was sent also to all physicians in the State. The prenatal clinics were furnished with a poster on prenatal care, for display.

(*d*) *Obstetric Package Project:*

Demonstration of the making of obstetric packages for use at home deliveries was continued by the supervisory nurses. These packages were provided in seven additional towns during the year.

(*e*) *Delivery Nursing Service:*

In communities where no delivery nursing service is available this Division, as part of the Social Security Program, through a grant of funds from the United States Children's Bureau, provided nursing services at the time of delivery to needy cases during the year. A total of 36 delivery nursing fees was paid from this fund in 1940.

(*f*) *Maternal Mortality Study:*

Through the Division of Child Hygiene, the Section of Obstetrics and Gynecology of the Massachusetts Medical Society, in cooperation with the State Department of Public Health, continued the study of maternal deaths in Massachusetts. From January 1 to December 31, 1940, there were completed a total of 221 maternal mortality investigations.

The same Committee continued the study of Caesarean sections during the year, in cooperation with the State Departments of Public Welfare and Public Health. The State Department of Public Welfare secured pertinent information regarding Caesarean sections from the maternity hospitals in the State now under the supervision of that Department.

Results of both the above studies will be reported at the annual meetings of the State Medical Society.

(*g*) *Premature Infant Program:*

That part of the program for the care of premature infants carried on through the Hospital Centers for the Care of Premature Infants, continued to function throughout the year as previously. However, there were several changes made in nursery supervisors in some centers and some of the new appointees lacked specific training in this work. As the Children's Bureau discontinued the use of funds for hospitals not supported by governmental funds, it became necessary to discontinue the two-weeks' refresher courses previously offered at Boston Lying-In Hospital. This was a serious handicap to our premature program as nursing care of premature infants is one of the most important factors in the prevention of deaths of premature infants.

To help the situation in some slight degree, four observation centers were established in the following Hospital Centers: Holyoke Hospital, Quincy Hospital, Salem Hospital and Worcester City Hospital. Because of lack of funds it was possible to give only one day's observation at these Centers. From the following hospitals 21 nursery supervisors took advantage of this observation service:

Fall River	Saint Anne's Hospital
Fitchburg	Burbank Hospital
Framingham	Framingham Hospital
Gardner	Henry Heywood Hospital
Gloucester	Addison Gilbert Hospital
Great Barrington	Fairview Hospital
Haverhill	Haverhill Hospital
Hyannis	Cape Cod Hospital
Lawrence	Lawrence General Hospital
Lowell	Lowell General Hospital
Lynn	Lynn Hospital
Northampton	Cooley Dickinson Hospital
Pittsfield	House of Mercy Hospital
Weymouth	Weymouth Hospital

This is the first year that the services of a full-time nurse were not available for the premature program. For several weeks a supervisory nurse was available, following which the state public health nursing supervisors in the various districts took over the supervision of Hospital Centers for the Care of Premature Infants.

The death rate from prematurity in 1939 was 12.5, as compared with a rate of 14.4 in 1938. A study of the deaths of premature infants was organized this year. This study will be participated in by the physicians caring for premature infants in the hospital centers. The study will be made by the Advisory Subcommittee for the Care of Premature Infants, with representation from the hospital physicians. Record forms were prepared to be filled out by the hospital physicians and submitted to the Division for study. The results of the study will be reported to the hospital centers concerned.

Upon request of the Children's Bureau of the United States Department of Labor, the improvised incubator of the Division was sent to Washington to be tested by the Children's Bureau and the United States Bureau of Standards. It was reported that our incubator came through the tests with a good rating.

The Assistant Director of the Division presented a paper on "The Massachusetts State Program for the Care of Premature Infants" at the New England Health Institute held in Hartford, Connecticut, and at the annual meeting of the American

Public Health Association, held in Detroit, Michigan. For the latter paper a series of lantern slides was prepared showing two views of the incubator, three of the carrying basket, and three of charts illustrating deaths of premature infants in hospitals of Massachusetts, 1937–1939; deaths from prematurity in Massachusetts, 1934–1936 and 1937–1939; and number of prematures transferred to hospitals for care, Massachusetts, 1937–1939.

The Subcommittee on the Care of Premature Infants held three meetings during the year, chiefly concerning the study of deaths of premature infants.

Local boards of health continued their cooperation with this Department in reporting the births of premature infants in homes, giving information requested on the forms provided by this Department. Such reports were received from 50 cities and towns, reporting a total of 300 premature infants born in their homes during the year.

(*h*) *Standards for Licensing Hospitals:*

The State Department of Public Welfare requested this Division to form a committee to consider revision of standards for the licensing of hospitals. This committee was formed and held one meeting at which a subcommittee was formed to work on standards for hospital records for maternity cases admitted to hospitals. Such standards were produced and presented to the committee appointed by the Section on Gynecology and Obstetrics and the Massachusetts Medical Society.

(*i*) *Well Child Conferences:*

The demonstration Well Child Conferences were continued as usual throughout the year by the two Well Child Conference Units of the Division. In 59 towns a total of 3,228 examinations were made during the year; these included the examination of 348 infants and 2,880 preschool children. In 56 towns there were held demonstration Well Child Conferences and in 14 towns Nursery School examinations; 1 town had both the demonstration conference and the Nursery School examination. In 8 towns conferences were carried on where an outside physician was employed by the community but the other conference members belonged to the Unit staff of this Division. In this group of towns 164 examinations were made.

In the towns of Mashpee and Millville we continued to give service at six-months' intervals and this year we undertook to give annual service to the towns of Granville and Tolland. The latter conferences were not planned on a six-months' basis because there are no two periods six months apart when roads are in sufficiently good condition for the mothers to get to the conferences. It is impossible to hold this conference earlier than late June.

During 1940 there were 15 communities in which the conferences were taken over locally.

The following table summarizes the activities in connection with the demonstration Well Child Conferences and the Nursery School examinations.

Summary — Well Child Conferences and Nursery School Examinations — 1940

Well Child Conferences	2,929 examinations—56 towns
Nursery Schools	299 examinations—14 towns
Total	3,228 examinations—69 towns (1 town had both a W.C.C. and a N.S.E.)

	Number	Per Cent
Infant examinations	348	11%
Preschool examinations	2,880	89%
Total examinations	3,228	100%
Repeats (Children who have also had examinations at previous conferences, usually in other years)	869	27%
Prematures (Children who weighed 5 lbs. or less at birth)	132	4%

	Total		Infants		Preschool	
	Number	Per Cent	Number	Per Cent	Number	Per Cent
Children with defects	2,863	89%	207	59%	2,656	92%
Children without defects	365	11%	141	41%	224	8%
Total children	3,228	100%	348	100%	2,880	100%

Children with major defects	1,942	60%	118	34%	1,824	63%
Minor defects	5,826	60%	269	60%	5,557	60%
Major defects	3,868	40%	179	40%	3,689	40%
Total defects	9,694	100%	448	100%	9,246	100%
Number of defects per child	3.0		1.3		3.2	
Number of minor defects per child	1.8		0.8		1.9	
Number of major defects per child	1.2		0.5		1.3	
Children with poor habits	1,396	43%	52	15%	1,344	47%
Children advised to see physician	1,062	33%	101	29%	961	33%
Children advised to see dentist	1,190	37%	–	–	1,190	41%
Children advised to see both	477	15%	–	–	477	17%
Children who have not been vaccinated	2,775	86%	344	99%	2,431	84%
Children who have not completed T.A.T.	1,859	58%	318	91%	1,541	54%

Unit I—W.C.C.	1,157	examinations	21	towns	
Unit I—W.C.C. (outside physicians)	164	"	8	"	
Total	1,321	"	29	"	
Unit II—W.C.C.	1,608	"	27	"	
Unit II—N.S.E.	299	"	14	"	
Total	1,907	"	40	"	(1 town had both a W.C.C. and a N.S.E.)
Grand total	3,228	"	69	"	(1 town had both a W.C.C. and a N.S.E.)

In 38 local Well Child Conferences the service of a Division nurse, nutritionist, dentist or dental hygienist was given. The physicians of the Division staff visited 18 local Well Child Conferences and 6 prenatal clinics.

In the towns of Easthampton and Sturbridge physicians were paid a fee for the conduct of the local Well Child Conferences, under the Social Security Program, through a grant of funds from the Children's Bureau. In Sturbridge, where formerly a fee was paid through this Division, the Well Child Conference has been taken over by the town.

To further the plan to meet community needs found at the Well Child Conferences, meetings were held following the conferences which included the specialists of the Division staff, for the discussion of these needs. During the year 17 such conferences were held.

Mimeographed outlines entitled "Organization and Conduct of a Well Child Conference" were provided for all Well Child Conferences conducted locally.

(*j*) *Examination of Entering School Children:*

We cooperated with the local Parent-Teacher Associations in plans for the examination of entering school children (Summer Round-Up), and with other local organizations and nurses, by providing printed material and advice for the conduct of these locally-conducted conferences. Reports were received from 236 towns, 158 of which had conducted examinations of those children who would enter school for the first time in the fall. Of these, 41 had had State service in some form, through State Well Child Conferences, Nursery School Examinations, or participation in local conferences by staff members of this Division.

2. School Hygiene:

(*a*) *Millville:*

The five-year demonstration carried on through this Division, with the Commission governing the Town of Millville, and financial assistance from the Wellesley Service Fund, was ended in 1940. The thought was to terminate the services at the close of the year but the Commission was insistent that it be continued, and it was planned to give service again to that community.

The Child Welfare Physician of the Division assigned to this service made 35 visits to the town in the interest of school medical services. Nutrition service was given to Millville, also, with special reference to the use of surplus foods. Audiometer testing was carried on for the school children of the town.

The following tables give statistics relative to the examinations of the school children and the defects found:

Results of Examinations of School Children

*Number examined	265
Number of children with major defects	195
Number of children with major defects (excluding teeth)	89
Number of major defects	305—1.1 defects per child
Number of major defects (excluding teeth)	120
Number of major defects corrected	137
Percentage of corrections	51
Number of irremediable defects	10
Number of new major defects	100
Number of minor defects	129

*Vision tests not completed, so not included.

Per Cent of Children Having Certain Defects

Most Prevalent Defects	
*Total number with defects	74
Defects of nutrition	13
Defects of posture	5
Defects of teeth	55
Defects of throat	5
Defects of nose	7
Defects of hearing	6

*Defects of vision not included; vision testing not completed.

(*b*) *School Hygiene Surveys:*

Three school hygiene surveys were made and recommendations based on the findings of the surveys were sent to the local school authorities for the towns of Athol, Maynard and Needham.

(*c*) *"Contact":*

This pamphlet continues to hold the interest of the school people. During the year five issues of "Contact" were sent to the school superintendents and school physicians. The policy has been continued of having a major article, a column by each of the Division specialists, State and national news, book reviews and discussion of a typical school problem.

(*d*) *School Physicians and Superintendents Meetings:*

School physicians and superintendents were organized to form county groups for the discussion of school health matters. Meetings were held in eight sections of the State during the year and proved to be popular and profitable. These meetings were in Hampden County, Berkshire County, Hampshire County, Essex County, Middlesex County, Northern Worcester County, Southern Worcester County, and the Old Colony District group which includes Barnstable, Bristol and Plymouth County officials. The total attendance was 234 which included 64 school superintendents, 75 school physicians, 27 school committee members, 6 agents of boards of health, 35 nurses, 4 physical education instructors, 11 school principals, 1 dentist, 4 dental hygienists, 1 teacher, 1 district health officer, 4 State officials and 1 other. The total number of cities and towns represented in these meetings was 126.

(*e*) *School Health Council of Massachusetts:*

The School Health Council of Massachusetts, which includes representatives of the State Departments of Public Health and Education, held six meetings during the year. The subjects of health examinations, safety, and first aid were discussed and policies established.

(*f*) *General:*

The publication formerly printed under the title "School Hygiene Handbook" was completely revised during the year for reprinting in a new form and under the new title "Guide to the School Health Program."

3. Public Health Nursing:

Through United States Public Health Service funds, under the Social Security Program, scholarships were awarded to two staff nurses for a year's course at Columbia University, and to one nurse for a summer school course at Simmons College.

Local nurses who had been granted scholarships previously received assistance in their community programs during the year from the supervisory nurses of this Division.

One staff nurse of the Division was granted a year's leave of absence for study at the University of Chicago.

"Health Supervision of the Preschool Child" was the subject discussed in one series of Institutes for public health nurses. These were one-day Institutes held in seven areas of the State, as follows: Boston, Harwichport, Lowell, Pittsfield, Taunton, Westfield and Worcester. Special emphasis was placed upon habit training of preschool children. The total attendance at this series was 593, of whom 482 were public health nurses. The second series of Institutes, on "The School Health Program," were held in the following communities: Boston, Lawrence, New Bedford, Northampton, Orleans, Pittsfield and Worcester. All interested in school health work were invited to attend this Institute. The total number attending was 629. Following these Institutes 66 group conferences were held for nurses in local communities and 27 study group conferences, for the discussion of local problems.

One-day Institutes on "Mental Hygiene" were held in Barnstable County and in Dukes County for educators and health workers. The total attendance at these was 260.

One Institute on "Tuberculosis" for industrial nurses was held at Essex County Sanatorium, the total attendance being 10.

The public health nursing supervisors continued their activities in stimulating tuberculosis nursing service and case-finding in the local communities. This service was rendered in 125 communities this year. One local tuberculosis clinic was established.

Toxoid clinics were promoted and held in 27 towns and 210 home visits were made in connection with communicable disease cases. In a local community where there was an outbreak of streptococcic sore throat, 119 visits were made, and a staff nurse of the Division was assigned to make these visits.

Community organization for Division Well Child Conferences was given by the supervisory nurses, 407 visits being made to further that program. They also participated in this organization in 36 communities where no such nursing service was available. Following the Well Child Conferences conducted by the Division of Child Hygiene Units, home visits totalling 943, were made by the public health nursing supervisors in those communities without generalized nursing service. A total of 81 maternity visits and 962 visits for infants and preschool children were made; 4 morbidity visits; 64 visits for school children; 12 for tuberculosis and 11 home visits in regard to crippled children, by the public health nursing supervisors of the Division.

Mothers' Classes were held in 16 communities, one of which was conducted by a staff nurse and the others under the supervision of the nursing supervisors; a class for fathers was also established in one community. Outlines for the conduct of these classes were provided through the Division of Child Hygiene.

In the field of school hygiene the supervisory nurses assisted in the school hygiene surveys and continued their supervisory services to the school personnel. They assisted in the program of health education; promoted home hygiene classes in schools as well as in communities, and furthered the establishment of health councils in three towns.

The Division supervisory nurses assisted in establishing new nursing services in six communities. They also assisted in the program planning of a series of eight meetings which were arranged for each of seven Nurses' Clubs. For one such club a mimeographed publication was started, entitled "Forward," to be issued bimonthly and to include pertinent information and news items for the nurses in the Berkshire County section of the State.

The supervisory nurses attended 39 clinics within their respective districts; carried on home visiting, in towns without nursing service, for women and children discharged from the Framingham Reformatory for Women, and referred to local nurses for supervision those in local communities where follow-up service is available, a total of 12 during the year.

In connection with the Maternal Mortality Study being carried on by the Department, the supervisory nurses assisted in the investigation of 73 birth certificates.

Staff nurses served with the Department exhibits at 11 of the State Agricultural Fairs during the summer and early fall. They gave a total of 112 lectures on public health nursing and related subjects during the year, reaching a total attendance of 4,247 people. One supervisory nurse was appointed to the committee of the Massachusetts State Nurses' Association, to confer with other committees in regard to the State Defense program initiated by the Governor. The object of this committee of nurses was to bring about co-ordination as to what hospitals, physicians, and nurses could do in case of national need. The supervisory nurse attended the meeting of the general committee held in the late fall.

The Supervising Instructor in Public Health Nursing and the Public Health Nutrition Supervisor attended the two-day Institute sponsored by the Children's Bureau of the United States Department of Labor, held in New York City.

Two staff nurses were among the five staff members who attended the New England Health Institute held in Hartford, Connecticut.

Supervisory nurses assisted in the promotion and establishment of dental service in six towns; also in the establishment of communicable disease nursing in one community, and in the use of the obstetric package for home deliveries in 7 communities.

One staff nurse participated in summer school courses held in Fitchburg, at the State Teachers College, and another in four Extension Courses in Health Education. Two participated in courses given for Well Child Conference Physicians and Prenatal Clinic Physicians, lecturing on the subjects: "Nursing Activities of the Division of Child Hygiene" and "Nursing Services During Pregnancy." Three lectures were given in these courses.

The staff nurses of the Division continued to give consultant service to local visiting nursing associations, county public health associations, community health committees, boards of health, boards of public welfare, town managers, parent-teacher associations, and other health, social and lay organizations, groups and individuals.

Two public health nursing supervisors were assigned to the Worcester Health District, organization of which was completed during the year.

The supervisory nurses assisted in the program planning of the State Nurses' Association, State Industrial Nurses' Association, State League of Nursing Education, and the Massachusetts Organization for Public Health Nursing.

4. Nutrition:

For professional improvement staff meetings for the nutritionists of the Division were held monthly throughout the year, outside speakers being secured to address the group on several occasions.

One public health nutrition worker was granted scholarship for a six-weeks' course at Boston University during the summer.

Nutrition instruction to the personnel of five local prenatal clinics was given by one of the public health nutrition workers.

During the year nutrition service was given to six tuberculosis sanatoria.

(a) Well Child Conferences:

Two nutritionists are assigned to the two Well Child Conference Units to assist in the educational service provided by this activity. The demonstration nutritionists served at Well Child Conferences conducted locally by the towns, as well as in the State Well Child Conferences held in their districts.

A summary of the findings at the Well Child Conferences covered by both Units for the years 1939 and 1940, is as follows:

	1939		1940	
Number of children examined by physicians	4,040	–	3,228	–
Number of children showing good nutrition	2,834	70%	2,286	71%
Number of children showing slight defect	862	21%	703	22%
Number of children showing moderate defect	305	8%	207	6%
Number of children needing immediate attention	39	1%	30	1%
Number of children seen by nutritionists	3,736	–	3,032	–
Number of families represented	3,006	–	2,366	–
Number needing more milk	739	20%	700	23%
Number needing more fruit	1,213	32%	1,168	39%
Number needing more vegetables	1,699	45%	1,133	38%
Number needing more whole grains	1,811	48%	1,298	43%
Number needing budget advice	1,133	30%	1,278	43%

(*b*) *School Lunch:*

This service was continued by the public health nutrition workers of the Division. During the year 380 visits were made to 143 cities and towns in the interest of providing adequate school lunches for the children. Numerous conferences were held for the discussion of school lunch projects and talks were given to stimulate interest in this project.

For trained and untrained school lunch managers a one-week course of instruction was carried on at Fitchburg State Teachers College, several members of the nutrition staff participating. The attendance included 55 school lunch managers from 33 towns. Among this group were a number of Works Progress Administration lunch managers, sent by that organization.

(*c*) *Community Nutrition Service:*

Nutrition Demonstrations: One nutritionist gave continuous service in Barnstable County where a nutrition demonstration was in progress for eleven months. Then through Federal funds, a full-time nutritionist was assigned to the County Health District staff, and the nutritionist who formerly carried on the demonstration nutrition service was transferred to the staff of the Worcester County Health District. Throughout the year weekly articles entitled "Facts About Food" were prepared by the nutritionist for publication in the local newspaper. This will be continued.

In the four towns of Hanson, Hingham, Norwell and Pembroke, a nutrition demonstration was carried on by another public health nutrition worker. As a result of this demonstration the Town of Hingham has employed its own nutritionist. Two other towns, Cohasset and Marshfield, have been added to the demonstration area.

(*d*) *Nutrition Education:*

State Teachers Colleges: As in previous years, the Division of Child Hygiene cooperated with the State Department of Education in providing courses of instruction in nutrition at Fitchburg State Teachers College. One public health nutrition worker carried on a summer course for four weeks for home economics teachers, nurses and school lunchroom managers. From the 22 towns represented there was a total of 43 home economics teachers taking the courses. The subjects covered were "Newer Trends in Nutrition," "Nutrition Facts and Method of Teaching" and "Nutrition for Nurses." From 8 towns there were 10 nurses taking the course, and from 33 towns there were 55 school lunchroom managers.

Nutritionists participated in the Health Education Course given at Fitchburg State Teachers College during the summer.

At Framingham State Teachers College a nutritionist gave a lecture on "Nutrition" to three different classes during each semester.

(*e*) *Department of Public Welfare:*

Again assistance was given to the State Department of Public Welfare. At the request of the Commissioner of Public Welfare the Public Health Nutrition Supervisor conferred on many occasions with the representatives of that Department regarding policies of both departments, budgets, etc. The Nutrition Supervisor was called upon to assist in the examination for the position of home economist in the State Department of Public Welfare.

(*f*) *Works Progress Administration:*

The Director of the Division of Child Hygiene and the Public Health Nutrition Supervisor were appointed to serve on the State branch of the Federal Surplus Marketing Administration. This committee is concerned with nutrition service in connection with Works Progress Administration nutrition activities, school lunches, etc. Through the efforts of the Nutrition Supervisor it was possible to secure the cooperation of the Works Progress Administration in sending their lunchroom managers to Fitchburg State Teachers College for the one-week conference of lunchroom managers. These conferences included 21 lunchroom managers under Works Progress Administration.

In connection with the use and distribution of surplus commodities continued cooperation was effective during the year between the Surplus Commodities Commission and this Division. Stress was laid upon the value of employing a trained manager to supervise the distribution of surplus commodities and their use. One such manager was appointed as executive secretary of the State-wide School Lunch Advisory Committee. The Public Health Nutrition Supervisor is a member of that Committee also. Many conferences were held with officials of the Surplus Commodities Commission with regard to policies, recipes, etc., for the use of surplus commodities for providing school lunches for needy pupils.

(*g*) *General:*

The Fourth Annual Conference of New England Nutritionists was called by the Division and held in Boston. The topic for discussion was "Family Defense" and the speakers were Dr. Sebrell of the United States Public Health Service, Dr. Harris of Massachusetts Institute of Technology, Miss Hazeltine of the United States Children's Bureau, Miss Stern of Boston Dispensary, Miss Foster of Quincy, and a nutritionist of the Division of Child Hygiene of this Department. There were 77 nutritionists and others in attendance and all of the New England States were represented.

A total of 184 group meetings were held by nutritionists, the total attendance being 4,471. Talks on nutrition subjects during the year totalled to 306, with a total attendance of 12,770. There were 177 home visits made by the nutritionists. Surveys were made of two school lunches and two food price surveys were made. A course of eight lectures was given to 120 teachers. Consultation service was afforded frequently and the nutrition program of the Department outlined for 24 out-of-state workers in the nutrition field; field observation service was provided for them as well.

During the year three communities employed nutritionists under local auspices — Dedham, Hingham and Quincy.

The nutritionists participated in various meetings in the State and prepared papers for annual meetings of the Massachusetts Dietetic Association; Massachusetts Home Economics Association; Institute for New England Nutritionists; and various organizations within the State; also for the American Dietetic Association meeting held in New York; the Rhode Island Nutrition Association meeting, and the Regional Conference on Nutrition for public health nurses and nutritionists of the northeastern area, called by the Children's Bureau of the United States Department of Labor, and held in New York. The Nutrition Supervisor was a delegate, with the Supervisor of Nursing Education, to this two-day institute. She also participated in the Wellesley Institute, lecturing on "Science and the Nation's Food." All the nutrition staff attended a week's refresher course given by the Massachusetts Dietetic Association.

5. Dental Hygiene:

The dental health activities of the Department were carried on as usual through cooperation with schools and communities in introducing dental health education; through organization to promote dental services, and through lectures to professional and lay groups. Courses were given to teachers in three communities and to public health nurses in two communities. Lectures were given to student nurses in 19 hospitals. Conferences were held in 44 hospitals to promote dental service in prenatal clinics or to establish dental internships. In the Health Education Course given at Fitchburg State Teachers' College lectures were given on dental health, and in the University Extension Courses held in cooperation with the State Department of Education similar lectures were given.

There were 10 dental surveys made in community schools for the purpose of promoting dental service and education; these included a total of 1,647 children.

Approximately 5,702 people were reached through the 95 lectures given on dental subjects during the year.

Consultation service was afforded local organizations and lay groups seeking advice and assistance relative to local dental programs.

Dental exhibits were prepared for display at the meetings of the Northeastern Dental Society held at Swampscott, and for the Massachusetts State Dental Society Convention; also for the Boston Young Women's Christian Association.

(*a*) *Preschool Program:*

For the Division Well Child Conferences and the Nursery School Examinations the physician-dentist, the dentist and the dental hygienists served during the year. At these conferences there were given 31 dental examinations and 2,945 dental inspections, a total of 2,976 in the 61 towns included. For local Well Child Conferences the service of a dentist was afforded for the examination of 75 children in two towns and the services of a dental hygienist for inspections of 216 children in three towns. In one town a preschool dental survey was made by a staff dentist which included the examination of 78 children.

(*b*) *School Program:*

Talks were given in every grade in 15 schools in 6 towns, reaching an attendance of 1,941 pupils. These were planned primarily for the purpose of introducing the use of visual aids in dental health teaching into the schools.

Three issues of the "Bulletin for Massachusetts School Dental Workers" were sent out during the year. One issue stressed dentistry for high school pupils and another included the new "Dental Reporting Form" made available through the Division, for classroom teachers.

(*c*) *Dental Education of Medical and Dental Professions:*

Professional public health education is included in the dental program of the Department. During the year this comprised formal lectures to students at Harvard School of Public Health, Harvard Dental School, Boston University Medical School, Tufts Dental School, and Forsyth Infirmary Dental Hygienists Training School. These were given by the physician-dentist of the Division of Child Hygiene.

(*d*) *Institutes for Dentists:*

In cooperation with the Massachusetts Dental Society and the United States Public Health Service a series of Institutes on Children's Dentistry were conducted in 10 sections of the State, as follows: Pittsfield, Holyoke, Greenfield, Worcester, Ayer, Boston, Walpole, Swampscott, New Bedford and Hyannis. These consisted of lectures and demonstrations. In each center two meetings were held for dentists only; they included a demonstration in practices in children's dentistry by Dr. Pelton of the United States Public Health Service, and a clinical demonstration of ethyl chloride anesthesia by Dr. Weller of Forsyth Dental Infirmary. An evening meeting was conducted in each center for the local people in the vicinity interested in a community dental program. At these evening meetings Dr. Pelton was the principal speaker and a local physician spoke on the opinion of the medical profession toward dental service for children; a local dentist discussed the dentist's attitude toward children's dentistry. Attendance at these meetings included 255 dentists and 834 lay people, a total of 1,089 for the series.

(*e*) *Cooperation with Dental Societies:*

Again, the physician-dentist of this Division served as secretary of the School Health Education Section of the American Association of Public Health Dentists, and edited factual material on dental health collected for presentation at the annual meeting of that Association. She served also as chairman of the Public Health Committee of the Massachusetts Dental Society, and continued to serve as secretary-treasurer of the Oral Hygiene Council of Massachusetts.

Co-operating with the Public Relations Committee of the State Dental Society, a survey was made of dental services available for indigent persons throughout the State. The findings of this survey were published in the *Bulletin of the Massachusetts Dental Society*, October, 1940.

(*f*) *General:*

In accord with the policy of the Department, stress was laid upon the necessity of educating and interesting local people in the importance of securing dental care through their local dentists wherever possible. To further this dental health program a notice to parents was prepared for use through the schools.

One staff dentist was granted scholarship at Harvard School of Public Health, through funds from the United States Public Health Service, under the Social Security program.

Two dental hygienists were granted scholarship funds from the same source for a course at Forsyth Dental Infirmary, entitled "Public Health Education for Dental Hygienists." This course was conducted by the Coordinator of Health Education of the Division of Child Hygiene, and included 17 dental hygienists.

Members of the dental staff participated in a dental health program at the Boston Young Women's Christian Association.

6. Parent Education:

In the field of Parent Education the courses for teachers, nurses, and social workers were continued during the year. These included four lectures on "Understanding Human Behavior" and were given in eight communities. The total attendance was 930.

Two credit courses for teachers were given at Fitchburg State Teachers College, one on "Family Relationships" and one on "Nursery School Problems."

Separate lectures were given to other professional and lay groups by the Parent Education Coordinator. The total for the year was 99 lectures, with a total attendance of 6,588.

Numerous group conferences were held, as well as conferences with individuals, for the discussion of parent education problems. Consultation services were made available to organizations, groups, and individuals throughout the State. Home visits were made with the division supervisory nurses and with other local public health nurses, to cases in their districts showing behavior problems.

(*a*) *Lay Leaders Training Project:*

There was held in the spring a three-day conference for the present group of Lay Leaders in Training. This included a very interesting discussion of community projects carried on by these leaders.

In the fall a one-week intensive course was conducted on the subject "The Preschool Child." New community projects within that field were started in communities covered by these Lay Leaders in Training, under the supervision of the Coordinator of Parent Education.

During the year 34 conferences were held with Lay Leaders in Parent Education.

(*b*) *Teachers and Parents Groups:*

A series of weekly lectures were given throughout the spring to teachers in the superintendency union of Seekonk and Rehoboth, on "The Diagnosis and Treatment of Classroom Problems." These were followed up in the fall by a continued series held weekly, for credit, through the cooperation of the University Extension Division of the State Department of Education. Dr. Gardner, psychiatrist of Judge Baker Guidance Center, participated in this project. An annotated booklist was compiled covering every phase of parent education. As part of this project several meetings were held for parents during the year.

7. Research Learning Project:

At the end of June the first part of our learning project was ended, except for publications on the various studies. These are in preparation.

The Massachusetts Vision Test was completed and now is in the hands of manufacturers; test kits will be on the market in the near future. Directions for their use and a pamphlet on eye hygiene are in preparation.

The new project — Field Service in Child Growth and Development — includes the children in nursery schools, kindergarten and lower grades. This is a consultation service to assist the superintendents of schools and school personnel to solve problems preventing normal growth and development, met in schools and homes.

(*a*) *Education and Service:*

Educational activities in this field included lectures, classes, clinic conferences, and individual conferences. The ophthalmologist read a paper before the American Medical Association in June, on the subject: "Massachusetts Vision Test — An Improved Method of School Eye Testing." The Head of the Research Learning Project gave 28 individual talks, the total attendance being 2,521 people. She also gave a one-week course at Fitchburg State Teachers College for a group of 25 teachers.

The Research Learning Consultant assisted in the vision testing program by carrying on the vision tests in 10 towns, which included 131 schools and 8,800 pupils.

The Child Welfare Physician (ophthalmologist) served during the first half of the year in the research field. Owing to the completion of this phase of the project he severed his connection with the Division the end of June.

Through scholarship funds from the United States Public Health Service for in-service training, the Head of the Research Learning Project was granted opportunity for attendance at a six-weeks' course at Dartmouth College Eye Institute

8. Social Work:

A Public Health Medical Social Work Supervisor was added to the staff of the Division of Child Hygiene in November, to give consultation service to members of the staff and to local organizations and communities, through their agents. She has been assigned to the Worcester Health District for part-time service.

9. Audiometer Testing:

The plan was continued of offering the services of the public health nursing supervisors to demonstrate the use of the audiometer to a person, or persons, designated by the local superintendent of schools, so that the audiometer testing could be carried on locally. Numerous requests were received from superintendents of schools throughout the year for the use of audiometers which were demonstrated by the public health nursing supervisors of the staff. Three audiometers were in constant use during the year.

During the calendar year 1940 audiometer service was given to 92 towns. The total number of children given audiometer tests during the year was 32,958; 7,091 (22%) were retested; and 1,977 (6%) were found to have a hearing loss.

10. Health Education:

The work of the Coordinator of Health Education has progressed along the lines of the program as developed during the previous year. Her work has fallen in four general fields — general adult community health education, assisting in the in-service training of public health personnel, as a specialist in educational methods for the Department staff, and in the field of teacher-training for health education in the schools.

(*a*) *Schools:*

During the past school year, cooperating with the University Extension Division of the Department of Education, the Coordinator of Health Education conducted health education courses for teachers in Danvers and Springfield. These courses consisted of 16 lectures. In Danvers the total attendance was 16 and in Springfield, 32. The latter included school principals, physical education directors and school nurses, as well as teachers.

At Fitchburg State Teachers College three courses were given on health education subjects. The Health Education Coordinator also took part in the Health Education Institute for teachers and nurses in vocational schools of the State, held also at Fitchburg State Teachers College, during the summer.

A University Extension Course in public health education for dental hygienists was given at Forsyth Dental Infirmary. This course was carried on for 16 weeks and 17 dental hygienists took advantage of it. The Health Education Coordinator also participated in the course in health education carried on at Forsyth Dental Infirmary Training School.

A class in public health education was conducted for the nurses of Fall River Visiting Nursing Association, 10 of whom attended; also for the public health nurses in the City of Springfield Health Department, the attendance totalling 40.

A coordinated plan of nutrition and community health education teaching was developed in the Town of Barnstable, and a similar plan in relation to dental health was developed in the schools of Yarmouth.

The new course of study in health education for junior high schools was published as a joint project between the State Departments of Education and Public Health. The following bulletins were completed for printing during the year:

I. Suggestions to School Administrators for Health Teaching
II. Suggested Teaching Units in Community Health
III. Suggested Teaching Units in Physiology as Applied to Daily Living
IV. Home Nursing and Child Care
V. First Aid for Boys

The Coordinator of Health Education gave consultation service to school administrators relative to their local health education programs; also service and consultation in local community health education programs. She also gave 133 lectures on health education subjects, reaching a total of 4,035 people.

The Public Health Education Worker of the Division was assigned to special work with high school pupils and carried on a successful program during the year. She gave talks on "Personality and Health" in 12 junior high schools and 67 senior high schools, reaching a total of 10,735 pupils. Talks were given to 17 Youth Organizations, reaching a total of 870; also before 11 professional groups, totalling 302 people, and 22 lay groups, totalling 1,214 people. Though the talks before high school groups were planned primarily for girls, requests were received for similar talks for boys, and this service was added during the year.

The Health Education Worker was in attendance at the exhibits of the Department displayed at Agricultural Fairs during the summer and fall, and gave 41 days' service to this type of health education.

(b) *May Day — Child Health Day:*

The usual service was given to this activity, assisting schools in their local programs. "A Better Chance for Every Child" was the slogan for this year's nationwide activity. Based upon the President's proclamation regarding May Day — Child Health Day, a State Child Health Day statement was prepared and a news release was sent to the newspapers. In a radio talk given by the Director of the Division and the Child Welfare Physician-Dentist, dental health as a contributing factor was stressed. Churches were requested to emphasize the importance of child health in their announcements. Printed material of the Department of Public Health was provided to local communities for distribution during their celebration of Child Health Day programs.

(c) *Exhibits, Posters, Pamphlets:*

The Chief Supervisor of Health Education gave considerable time to the planning and construction of Department exhibits to be used at various agricultural fairs in the State and for other organizations. He completed 82 pieces of new health educational material, four of these for Divisions other than Child Hygiene; repaired, corrected and renovated 36 additional pieces of exhibit material, 10 of which were for other Divisions. For special exhibits during the year two large Department exhibits were prepared on "Shellfish" and "Mosquito Survey of the Department," and 6 new smaller exhibits were completed.

From schools, libraries, hospitals, boards of health, nursing organizations and industrial plants there were constant demands for the health exhibits throughout the year. Of particular interest were those displayed at annual meetings of the Massachusetts Medical Society; Massachusetts State Nurses' Association; New England Hospital Association; New England Drug and Health Show; and Eastern States Exposition held in Springfield. The large Department exhibits were displayed at these.

Smaller exhibits showing activities of the Division of Child Hygiene were displayed at Boston Book Fair; American Association for Health, Physical Education and Recreation meetings in Boston; Young Women's Christian Association, Boston; New England Health Education Institute at Massachusetts Institute of Technology; Kiwanis Club in Salem; Lynn Health Week; Massachusetts Federation of Women's Clubs, Swampscott; Conservation Show, Worcester, and the Worcester Health Week. Exhibits were used also to supplement lectures given by staff members to the number of 37. In addition to the Eastern States Exposition, exhibits were on display at 13 other local agricultural fairs. At all of these staff members of the Department were in attendance.

Requests for printed material were numerous. From the agricultural fairs 488 were received from residents of the State and 38 from other New England States, New York, Pennsylvania, Ohio and Wisconsin. From the Boston Book Fair there were received 811 requests for pamphlets, 15 of which were from outside the State, an increase of more than 25% over the previous year's demand.

The Supervisor of Health Education gave three lectures in the course for student dental hygienists at Forsyth Dental Infirmary; two in the course at Fitchburg State Teachers College, and single lectures on visual aids to health education to six other groups. Through 11 lectures of this nature, 1,290 persons were reached.

During 1940 a total of 183,457 pieces of health education material were ordered on the school order blanks, and 38 sets of posters were distributed to public and parochial schools in the State. Requests from fairs totalled 9,511 pieces, aside from the Boston Book Fair from which were received requests for 6,029 pieces of printed material.

The health education group gave a total of 287 lectures, the total attendance being 19,558.

In addition to health teaching bulletins printed in cooperation with the State Department of Education, a new pamphlet was issued, entitled "What Every Girl Should Know."

(*d*) *Publicity:*

The Public Health Education Worker prepared publicity material for two institutes for nurses on "Health Supervision of the Preschool Child" and "The School Health Program"; for May Day — Child Health Day, and for the Institutes for Lay Leaders in Parent Education.

(*e*) *Library:*

The Library Committee held meetings as usual during the year and approved the purchase of books for the Department Library and for special Division libraries. For the use of the Department staff 136 new books and pamphlets were added to the main library, accessioned, classified and catalogued when received. For special use of staff members under the Social Security program 43 books and pamphlets were purchased. Journal subscriptions and society memberships numbered 87.

Reprints, pamphlets and booklets received during the year were classified, catalogued and filed for reference use.

This year "The Commonhealth" was published semiannually, the January to June number being devoted to "Sanitation" and the July to December number to "School Studies," 7,000 copies of each issue being printed.

Through interlibrary loan 194 books and journals were secured through other libraries for reference use of members of the Department staff.

Manuscript was prepared for Bulletins I, II and III of the Massachusetts Course of Study in Health Education, printed in cooperation with the State Department of Education.

(*f*) *Lectures, Motion Pictures, etc.:*

There were reported as being given during the year by the staff of the Division of Child Hygiene a total of 1,042 lectures. These lectures were given in 195 towns in the State and in 12 cities outside Massachusetts. Aside from radio listeners, approximately 56,312 people were reached through this lecture service. Members of the Division staff gave 12 radio broadcasts and 8 Health Forum broadcasts this year.

Motion picture films were loaned to 75 communities. These are all on health subjects and are in constant demand throughout the year. To supplement the film library there were added during 1940 new films on the following subjects: Prenatal and Infant Care, Nutrition, and several on Science.

(*g*) *Prenatal and Postnatal Letters; and Father's Letter:*

At the close of the calendar year there were on the registry to receive the monthly letters to prospective mothers and to mothers of children under two years of age approximately 31,210 names. New requests for prenatal letters during the year totalled to 8,409; new requests for postnatal letters covering the care of infants under one year of age totalled to 9,164; both of these series of names were carried along to receive the letters on the care of infants during the second year of life. At the close of the year there were registered for second year postnatal letters a total of 14,701 mothers' names. During the year the letter to fathers was sent to 8,409 fathers when requests were received for the prenatal letters for the mothers.

(*h*) *Cooperation with Outside Agencies:*

Continued cooperation was afforded the State Departments of Agriculture, Education, Extension Service, Mental Health, Public Welfare, Teachers' Retirement Board, and other State organizations. Members of the staff of this Division served on committees of national, State and local organizations interested in health and social problems and programs for the promotion of the health of mothers and children and of families in general.

Staff members participated in plans for field training for students from Harvard School of Public Health; the physicians taking courses for prenatal clinic physicians and for well child conference physicians; nurses and nutritionists taking courses at Simmons College, and visitors from other states and other countries than the United States. For individuals and groups requesting it, much time was spent in outlining the activities and resources of the Division of Child Hygiene and the Department.

(*i*) *Staff Education:*

One dentist was granted scholarship funds to complete a course at Harvard School of Public Health; two public health nurses were granted postgraduate education for nine months at Columbia University, through scholarship grant from the United States Public Health Service; another public health nurse was granted leave of absence for study for a year at Chicago University; one public health nursing supervisor was given scholarship for a summer course at Simmons College; the Head of Research Learning was given a summer course at Dartmouth College Eye Institute; two dental hygienists were given courses at Forsyth Dental Infirmary; the Public Health Education Worker was granted scholarship for two courses at Harvard College Graduate School of Education and one course at Massachusetts Institute of Technology; one nutrition worker was given a summer course at Boston University.

(*j*) *General:*

Through its activities and field program the facilities of the Division of Child Hygiene were made available to students in all special fields who were engaged in postgraduate education. Observation service was available at the Well Child Conferences conducted through this Division and also for nutrition field activities.

Members of the Division participated in the courses given at Simmons College School of Nursing; Simmons College School of Social Work; Harvard School of Public Health; Harvard Dental School; Tufts Dental School; Boston University; Forsyth Dental Infirmary Training School; State Teachers Colleges, and Wheelock School.

The Worcester County Health Unit was launched early in the year for complete health services in that area. Two of the public health nursing supervisors of this Division were assigned for full-time service in that area; also a public health nutrition worker; part-time services of a child welfare physician of the Division of Child Hygiene; part-time service of the newly appointed Public Health Medical Social Work Supervisor, and dental health service as required through the dental staff of this Division. Other members of this Division afford close cooperation with the Worcester Health District staff in furthering the activities of that district.

11. Postgraduate Instruction:

(*a*) *Postgraduate Courses for Physicians:*

Again the Department cooperated with the Massachusetts Medical Society, the Children's Bureau and the United States Public Health Service, in providing postgraduate courses for physicians. In the spring and fall these courses were carried on in 18 different centers in the State. In each series there were included lectures on pediatric and obstetric subjects. The total attendance was 807 physicians during 1940.

(*b*) *Courses for Prenatal Clinic Physicians:*

Two courses for prenatal clinic physicians were conducted by Harvard School of Public Health and the Division of Child Hygiene. Six physicians completed the course, representing the following communities: Westfield, 2; New Bedford, 2; Weymouth, 1 and Northampton, 1.

(*c*) *Courses for Well Child Conference Physicians:*

For physicians conducting local well child conferences, or planning to conduct them, a course was carried on by the Harvard School of Public Health, Boston Lying-In Hospital, Children's Hospital, and the specialists in the various fields of activity in this Division. Two physicians took advantage of this course, 1 from Cambridge and 1 from Fitchburg.

II. Advisory Committees:

The following advisory committees afforded advice and counsel to the Division of Child Hygiene and to the Department during the year, as required:

Advisory Committee on Maternal and Child Health Subcommittee on Care of the Premature Infant
Advisory Committee on Public Health Nursing and Social Service
Advisory Committee on Nutrition
Advisory Committee on School Hygiene
Dental Advisory Committee

Massachusetts Statistics for 1940

(Allocated)

Birth rate per 1,000 population	15.1
Death rate per 1,000 population	11.7
Infant mortality rate per 1,000 live births	37.5
Maternal mortality rate per 1,000 live births	2.8

Population (Federal Census, April 1, 1940)	4,316,721

REPORT OF THE DIVISION OF COMMUNICABLE DISEASES

Roy F. Feemster, M.D., Dr. P.H., *Director*

General Statement

The year 1940 was characterized by the fact that none of the communicable diseases reached epidemic proportions except in very localized areas, resulting in a low total for all communicable diseases of only 84,321 cases. With the exception of 1938, this is the lowest figure reported since 1933 when influenza was removed from the reportable list. Anterior poliomyelitis, diphtheria, meningitis, scarlet fever, and typhoid fever remained at low levels; rabies in humans has not occurred since 1935, and not a single case of smallpox was reported for the eighth consecutive year.

Prevalence of Certain Diseases

Anterior Poliomyelitis. For the third consecutive year this disease has been at an unusually low level. The 45 cases reported is below the figure of 76 for the previous year. Because there has not been a high prevalence since 1935, an increase in cases can be expected during the coming year. Such an increase began in the Midwest and spread eastward as far as New York during the past season. In recent years a peak of 1,000 cases per year or more has been reached in Massachusetts every four or five years.

Diphtheria. This disease has made a new low level as the total of 144 cases for the year is below the 159 cases reported in 1938, the lowest number recorded up to that time. This decrease was made possible by the fact that no community in which the immunizations were low happened to develop an outbreak of large proportions during the current year. Chelsea, Fall River, and Somerville showed an increase in cases and an incipient outbreak beginning in Framingham early in the summer was forestalled only by very active immunization of large numbers of preschool children. This was followed up in the fall with an acceleration of the school program and the immunization of further preschool children. The focus in Lawrence and Methuen has apparently quieted down, only an occasional case having been reported since early in the year.

It is well to keep in mind that diphtheria is just as fatal among those who contract the disease as it was twenty-five years ago. At the present time, one person out of fifteen becoming ill usually dies of the disease. With the fatality rate higher in those under five, preschool children should receive particular attention in immunization programs. The efforts of the Department to aid in increasing the number of children immunized are described later in this report.

Dysentery, Bacillary. Sporadic cases of this disease have continued to be reported from widely dispersed communities and outbreaks have occurred in various hospitals and institutions. However, the disease did not reach such epidemic proportions in the institutions as occurred in the previous year, so that there was a decrease from the 491 cases reported in 1939 to 327 cases in 1940. The Sonne dysentery bacillus continues to be the variety most frequently found, a position which it assumed only last year.

Encephalitis, Infectious. The number of cases caused by various etiological agents has been low, only 13 cases being reported during the year, none of them apparently due to the virus of equine encephalomyelitis. A careful check on each reported case of encephalitis, meningitis, and poliomyelitis has failed to uncover any which appeared to be due to the equine virus. In a few cases where the diagnosis was not clear-cut, examinations were made for neutralizing antibodies produced by the viruses of equine encephalomyelitis and lymphocytic choriomeningitis. In all cases, the examinations have proved to be negative.

Nine cases thought to be suspicious of equine encephalomyelitis in horses came to the attention of the Division of Livestock Disease Control but the clinical history in each case left considerable doubt that the condition was due to the equine virus. In none of the cases was the diagnosis confirmed by the isolation of virus from the brain.

The completion of the mosquito survey undertaken in connection with this probem is discussed elsewhere in this report.

Gastroenteritis. Outbreaks of gastroenteritis of undetermined etiology were somewhat less numerous than last year. However, some of the outbreaks assumed considerable importance because they affected the newborn in the obstetrical wards of several hospitals. Steps are being taken by these hospitals, as well as others not yet involved, to put into force stringent precautions to prevent the spread of such infectious agents when a case does occur in a nursery.

"*Influenza.*" No widespread outbreaks of severe colds and influenza-like infections occurred during the year. This fact was confirmed by the information collected from those organizations which have been voluntarily reporting absenteeism or the prevalence of upper respiratory infections.

Malaria. This disease has again dropped to an exceedingly low level with only seven cases being reported during the year as compared to 14 in 1939. These were either therapeutic infections purposely induced to relieve symptoms of central nervous system syphilis, or the disease was contracted outside of the State.

Measles. While this disease was somewhat below the average early in the year, there was a progressive increase in prevalence persisting into the fall which may indicate that the coming year will show another peak such as is reached every six or seven years in the State. The number of cases reported for the year is 21,698 which is somewhat lower than the 26,685 reported in 1939. The number of deaths has shown a further decrease, resulting in the lowest mortality rate and case fatality rate ever reported.

Meningitis, Meningococcic. The downward trend in this disease has continued, only 47 cases being reported during the year, the lowest number ever recorded.

Meningitis Due to Pfeiffer Bacillus. This disease has once more dropped back to a low level, eleven cases being reported as compared to 19 a year ago. How much of this is due to a decrease in the disease and how much due to the failure to make a proper diagnosis cannot be determined, but it is felt that it probably represents a real decrease as the Department is continually on the alert to discover cases, and physicians are becoming more familiar with the disease.

Paratyphoid Fever. After dropping off to a low level from the high incidence of 1937, this disease once more shows an increase to 105 cases as compared to only 33 for the previous year. Two outbreaks of 26 and 24 cases, respectively, and a few small family outbreaks account for more than half of the total, the remainder being single sporadic infections reported from many parts of the State. The etiological agent in 77 cases was S. typhi-murium, in 11 cases S. paratyphi B. The others were distributed between several other species.

Pneumonia. This disease has dropped to quite low levels with 4,332 cases reported for the year. Except for 1938 with only 4,296 cases, this is the lowest number reported since 1934. The number of deaths have likewise decreased, 925 being recorded as compared to 1,211 in 1939. Some of the decrease in deaths is undoubtedly due to the introduction of chemotherapy which now makes it possible to treat favorable cases with drug alone and reserve serum therapy or combined serum and drug therapy for those who fail to respond to chemotherapy, particularly those with positive blood cultures.

Progress in the pneumonia program is discussed below under Special Projects.

Rabies. For the fifth consecutive year not a single case of rabies in man has occurred in the State in spite of an increase in rabies in animals. However, this good record is made possible only by prompt action in discovering and quarantining dogs which bite humans, and in immediate treatment of all persons exposed to rabid animals or to animals in which it is impossible to prove whether or not they are rabid.

The number of cases of rabies in animals showed a sudden increase early in the year, spreading from a focus in southwestern Norfolk County and in southeastern Worcester County into communities to the west and northwest. Later in the year the disease again spread eastward into northeastern Norfolk and Plymouth Counties. Restraint orders and the inoculation of dogs against rabies were recommended in all communities in which rabid animals were discovered and in the communities immediately surrounding the same. In many instances, active programs of immunizing dogs were instituted and there is reason to believe that the further spread of the disease may have been limited by these prompt measures.

During the year clinics for the immunization of dogs have been held in the following communities:

Amesbury	Framingham	Millbury	Southbridge
Andover	Grafton	Millis	Spencer
Arlington	Hanson	Millville	Stoneham
Auburn	Harvard	Milton	Sturbridge
Bedford	Hingham	Natick	Swampscott
Belmont	Holliston	Needham	Upton
Berlin	Hopkinton	Newton	Uxbridge
Bolton	Hudson	Northbridge	Wakefield
Boylston	Hull	North Brookfield	Ware
Brookfield	Leicester	Oxford	Warren
Canton	Lexington	Palmer	Watertown
Carlisle	Malden	Petersham	Webster
Charlton	Marlborough	Phillipston	Wellesley
Clinton	Maynard	Reading	Westborough
Cohasset	Medfield	Scituate	West Brookfield
Concord	Medway	Sharon	Weston
Dover	Melrose	Sherborn	Westwood
East Bridgewater	Mendon	Shrewsbury	Winthrop
East Brookfield	Milford	Somerville	Worcester

Scarlet Fever. Beginning in July, 1939, for fourteen consecutive months, scarlet fever was making new low records for reported cases, with the single exception of the month of July, 1940. Beginning in September, however, the disease began to show a slight increase, and there is reason to believe that the next two or three years will show further increases to levels which have been reported in the past. Because of the low prevalence during the early months of the year, only 5,277 cases were reported as compared to 5,705 a year ago.

A discussion of the studies of scarlet fever immunization with formalinized toxin will be found later in this report under Special Projects.

Septic Sore Throat. Again no well-defined outbreaks of this disease have occurred in the State during the year. Physicians have reported 214 sporadic cases of sore throat, but these have been in small groups and not apparently spread by milk supplies except in one small community in the south central portion of the State.

Smallpox. For the eighth consecutive year no cases of this disease have been reported. The level of immunity in the population in the eastern portion of the country continues to increase because of the interest of health authorities in the states in this area, so that Massachusetts is being protected by a wide band of states with a degree of immunization approaching that of this State. Because of this fact it is possible that the good record of the past few years can be continued for some time to come, until it is broken by having someone who has acquired the disease elsewhere come into our State.

Tuberculosis. There has been a further decrease in the number of cases of both pulmonary tuberculosis and tuberculosis of other forms. A full report is given elsewhere by the Division of Tuberculosis.

Typhoid Fever. For the third consecutive year the number of reported cases of this disease has been less than 100, 86 cases being reported as compared to 59 cases in 1938 and 78 cases in 1939. This slight increase can be attributed largely to an outbreak of 13 cases in Somerville following a wedding party, food for which was prepared by a woman not previously known to be a typhoid carrier.

We are much concerned because persons upon our typhoid carrier list have been responsible for cases of typhoid fever. During the year six carriers have caused one or more cases. In practically every instance, the infections were due to the fact that either the carriers or members of their families were not thoroughly cooperative. In spite of careful explanations, they could not be impressed with the seriousness of the carrier state. In one instance, typhoid fever occurred in the son of a carrier. The son had positively refused to be vaccinated even though he was in daily contact with the carrier in the household. Since boards of health do not have the power to demand that these individuals be vaccinated against typhoid fever unless they are food handlers, the solution for the problem lies in continued effort to impress the seriousness of the situation upon the carriers and upon the members of their households. These instances in the present year form the exception to the rule that carriers under supervision seldom cause cases. It is to be hoped that we shall have another period of years in which no cases will arise from the carriers under the surveillance of the Department.

The discovery of new carriers during the year has not been quite as successful as in the previous year. Nineteen carriers were added to the list during 1940, 12 having been discovered in the investigation of cases and the others being added because they had continued to carry the organisms for at least twelve months after having clinical typhoid fever. In the table which follows, a comparison with previous years is shown. As a more accurate measure of the relative results in finding carriers causing infections, new columns are added to the table for the first time. In the column headed "Epidemiological Units," if more than one case can be attributed to a single source, the group is counted only once in calculating the per cent of epidemiological units in which the carrier responsible was discovered.

Year	Cases of Typhoid	Carriers Added to List	Rate per 100 Cases	Carriers Found in Investigation of Cases	Rate per 100 Cases	Epidemiological Units[1]	Per Cent of Units in Which Carrier Was Found
1936	135	15	11.1*	13	9.6	67†	20.3
1937	114	20	17.5*	16	14.0	96†	18.7
1938	59	19	32.2*	16	27.1	55†	23.6
1939	78	26	33.3*	21	26.9	66†	31.8
1940	86	19	22.1*	12	13.9	59†	20.3

[1]All cases resulting from the same source are counted as a single unit in this column.

*No adjustment has been made for those cases in which disease was probably contracted outside of State, numbering as follows: 1936—5; 1937—10; 1938—2; 1939—5; 1940—3.

†1936—4 units comprising 4 cases caused by known carriers.
1937—1 unit comprising 1 case caused by known carrier.
1938—1 unit comprising 1 case caused by known carrier.
1939—2 units comprising 2 cases caused by known carriers.
1940—6 units comprising 11 cases caused by known carriers.

The typhoid carrier list has increased from 153 to 159. Seven carriers have died during the year, and 4 were removed from the list following cholecystectomy. Three carriers have undergone gall bladder removal during the year and may possibly be removed from the list during 1941.

Undulant Fever. There has been a further increase in the number of cases of this disease, the number reported being 52 as compared to 40 a year ago and to 37 in 1938. These cases have been widely distributed throughout the State but have been much more numerous in the less densely populated areas than in the Boston area. Careful case histories taken upon those individuals contracting the disease during the year reveals that in most instances there is a history of the regular use of raw milk.

Whooping Cough. There has been no marked change in the prevalence of this disease, 7,959 cases being reported as compared to 7,548 a year ago. Since this disease tends to reach a high level every four or five years, it is possible that the increase during the latter part of 1940 indicates that the coming year will see the prevalence at a much higher level.

Other Diseases. No cases of psittacosis, Rocky Mountain spotted fever, or tularemia were reported during the year. The number of cases of trichinosis increased considerably, 46 cases being reported as compared to 14 a year ago and 29 in 1938.

Outbreaks

January. Diphtheria; Cambridge. Three members of one family, the mother and two small children, developed diphtheria. Third child who had received two inoculations was asymptomatic although positive cultures were found.

January. Paratyphoid B fever; Newburyport. Two cases in a family with six children. The other four children showed positive stools but no symptoms.

January. Bacillary dysentery; Pittsfield. Outbreak of Sonne dysentery in children's wards of a local hospital. Seven children and one nurse had positive cultures. All but one child showed clinical symptoms.

January. Bacillary dysentery; Salem. Outbreak of Sonne dysentery occurred in pediatric ward of hospital involving five children, a physician, and a nurse.

January. Typhoid fever; Norton. Four cases among the relatives of a typhoid carrier, one fatal case. Additional case in neighbor's child. Household contacts had refused prophylactic inoculations which had been urged by the Department.

January. Gastroenteritis; Roxbury. Outbreak among patients and personnel of a private hospital; symptoms mild, stool specimens failed to reveal etiological agent.

January. Bacillary dysentery; Westfield State Sanatorium. Five mild cases of Sonne dysentery among patients and employees.

January. Gastroenteritis; Westfield State Sanatorium. Explosive outbreak of 35 cases among patients in the institution; symptoms mild, recovery prompt, source and etiology undetermined.

February. Gastroenteritis; Bridgewater State Farm. Outbreak of gastroenteritis among employees of hospital. Probably staphylococcus food poisoning spread through chocolate cream pie.

February. Gastroenteritis; girls' college, Northampton. Thirty cases of gastroenteritis; no intestinal pathogen found.

February. Gastroenteritis; Nahant. Eight ill after eating chicken pie. No pathogen found after culturing chicken pie and stools of those ill. Probably staphylococcus food poisoning.

February. Gastroenteritis; New Bedford. A large number of individuals developed vomiting and diarrhea following the consumption of chocolate eclairs. Of 43 persons who were known to have eaten eclairs, 39 became ill. In the same families, 50 persons who had not eaten eclairs gave no history of illness. Stool cultures were negative for pathogens. Typical picture of staphylococcus food poisoning.

February. Bacillary dysentery; Belchertown State School. Diarrhea occurred in about 90 patients, employees and other residents of Belchertown State School. Positive stools for Sonne dysentery obtained on 34 persons. Cases occurred over a period of about one month.

March. Paratyphoid fever; boys' college. Ninety-five students with gastrointestinal symptoms following a banquet; stools on 29 found to contain paratyphoid organisms of typhi-murium type. Laboratory examination of specimens from food handlers were all negative. Many of those affected were part-time foodhandlers and had to be kept from their occupations until negative findings were obtained.

April. Gastroenteritis; girls' college, South Hadley. More than 80 students involved. Specimens from 20 showed no intestinal pathogens. Water analyses negative although by-passes with single gate valves were found. Water as a vehicle of spread barely possible.

April. Streptococcus sore throat; Waltham. Approximately 43 nurses and employees of a local hospital had sore throats which were positive for hemolytic streptococci. Initially, the outbreak was explosive and possibly food-borne. Secondary cases probably resulted from direct contact.

April. Typhoid fever; Somerville. Thirteen people ill following a wedding dinner. Woman who prepared the dinner was found to be a carrier. The vehicle of infection was probably stuffed turkey.

April. Paratyphoid fever; Pittsfield. Three cases among seven individuals in related families.

May. Paratyphoid fever; maternity hospital, Boston. Four cases due to Salmonella suipestifer in two mothers and their infants.

May. Epidemic diarrhea of newborn; maternity home, Westfield. Nine newborn infants developed diarrhea and seven died. No recurrence of cases after maternity and newborn wards were closed, cleaned and reopened with special precautions.

June. Bacillary dysentery; hospital, Baldwinsville. Eighty cases of diarrhea among the patients and employees. Thirty-seven cases had stools positive for Sonne dysentery bacillus.

June. Paratyphoid fever; Tewksbury State Hospital. Thirty cases, the majority of which were male patients, were caused by the typhi-murium strain. Source could not be determined.

June. Milk-borne sore throat; Dighton and Taunton. An outbreak of sore throat affecting 224 persons in Dighton and 60 in Taunton resulted from the consumption of raw milk from one dealer. No specific organism could be incriminated. This is the first authenticated milk-borne outbreak in this State during the past seven years.

June. Trichinosis; Wellesley. Seven members of one family and guest, ill after consuming uncooked smoked ham.

July. Bacillary dysentery; Worcester State Hospital. A sudden increase in Sonne dysentery cases raised the total number to 25 over a period of five months.

July. Paratyphoid fever; on cruise ship. Of 100 Massachusetts persons who might have been exposed to a typhi-murium outbreak while they were aboard a cruise ship, nine were found to have positive stools. Only one possible secondary case resulted.

July. Gastroenteritis; church society, Boston. Three hours after eating breakfast served by caterers, fifteen out of 155 ill; probably staphylococcus enterotoxin. The responsible article of food could not be determined.

July. Diphtheria; orphanage, West Newbury. One case of diphtheria and two suspicious cases. Routine immunization of children had not been practiced.

July. Gastroenteritis; on Boston boat. Diarrhea in members of the crew; suspicion pointed to chicken salad sandwiches; no pathogens from some ingredients of salad. Probably staphylococcus food poisoning.

July. Gastroenteritis; aboard a sailing vessel. An outbreak of appendicitis on board a training ship came to the attention of the Department. Because these cases might have been due to paratyphoid infection, they were investigated and it was learned that early in July a number of cases of gastroenteritis had occurred during the cruise. No pathogens were discovered upon culturing a number of those who were ill.

July. Typhoid fever; Quincy. Five children who developed typhoid had nothing in common except that they drank water from the same polluted brook. This same polluted brook was the probable source of infection of this disease in three children a year before.

September. Gastroenteritis; Belmont. Twenty-seven out of forty persons in ten families living on one side of a street became ill with vomiting and diarrhea. Stool cultures, taken relatively late, were negative. Water ruled out as source.

September. Gastroenteritis; Medfield State Hospital. About ninety who ate in the employees' dining room developed symptoms within two or three hours. Creamed chicken suspected as the vehicle in this outbreak of possible staphylococcus food poisoning.

September. Bacillary dysentery; Medford. Five children and one adult in a family of seven showed clinical and laboratory evidence for Hiss-Y dysentery. The infection was probably brought into the household by two of the children who came down at the same time.

September. Gastroenteritis; Boston. About thirty out of 115 women who attended a club dinner became sick. Roast beef was the vehicle of spread. No pathogens found.

September. Gastroenteritis; Tewksbury State Infirmary. About one half of the patients in the institution developed diarrhea almost simultaneously in about six hours after meal. Stools from several of those ill failed to yield intestinal pathogens.

September. Gastroenteritis; Walter E. Fernald State School. About twenty patients and employees developed acute gastrointestinal symptoms. Most of the cases occurred on one day. The causative agent and the vehicle of spread could not be determined.

September. Epidemic diarrhea of newborn; hospital, Boston. Of twenty-seven possible cases, eleven died. Five of the eleven deaths were in premature infants. No recurrence after reopening wards.

October. Bacillary dysentery; hospital, Cambridge. Some six children developed Sonne dysentery while on the pediatric wards of a local hospital. Two children who had been discharged were responsible for an additional six cases in their homes.

October. Bacillary dysentery; hospital, Boston. Seven patients and one nurse showed clinical and laboratory evidence of Sonne dysentery infection.

October. Typhoid fever; Waltham. Three cases among children in the same family; grandmother found to be carrier.

October. Gastroenteritis; girls' college, Cambridge. Vomiting and some diarrhea in twenty students; similar symptoms in cook on day previous; etiological agent could not be determined.

October. Septic sore throat; Sturbridge. Nine cases of septic sore throat, three of which had a scarlatiniform rash. Seven cases used raw milk from the town farm but outbreak probably spread by contact and not milk.

November. Gastroenteritis; Squantum. Twelve adults developed nausea, vomiting, diarrhea and temperatures as high as 101; no common food; stool specimens negative.

November. Gastroenteritis; Ashland. Twenty children had nausea, vomiting and a number had diarrhea; etiological agent could not be determined.

November. Epidemic diarrhea of newborn; Malden. Of thirteen newborn infants affected, four died. One of the deaths was in a premature child. No recurrence after reopening of wards.

November. Gastroenteritis; hospital, Everett. Six newborn infants developed diarrhea. Clinical picture differed from epidemic diarrhea of newborn. No deaths occurred. Cause of outbreak undetermined.

November. Trichinosis; Winchester. Seven cases among three families; no evidence that all had eaten same product.

December. Epidemic diarrhea in the newborn; hospital, Lawrence. Four infants affected, three died.

December. Gastroenteritis; hospital, Boston. Thirteen members of hospital personnel developed nausea, vomiting and diarrhea; fish cakes probable source. Cultures failed to reveal pathogens. Staphylococcus food poisoning probable.

December. Scarlet fever; Worcester State Hospital. Thirteen cases occurred in patients and employees over a period of seven weeks, apparently initiated by an employee with mild scarlet infection and spread through direct contact.

Assistance to Local Communities

Through the District Health Officers and the epidemiologists attached to the Central Office, assistance has been given to local communities on many problems of local health administration as well as on problems of communicable disease. The following will illustrate some of the types of assistance which have been given.

Epidemiology. In certain diseases in which it is important to search for the source of infection, such as typhoid and paratyphoid fevers, bacillary dysentery, and undulant fever, staff members lend active assistance to local boards of health in making investigations, in some small communities taking full responsibility of collecting the necessary data. Recommendations as to administrative procedures are then made so that proper action can be taken by the board.

In other diseases in which it is important to determine the exact causative agent, such as encephalitis and fevers of undetermined origin, the health officer assists in compiling an epidemiological record and aids in securing the necessary specimens for virus isolation or antibody determination in cooperation with Harvard Medical School.

In other diseases, such as diphtheria, pneumonia, and poliomyelitis, where administrative action is usually taken immediately by the local boards of health, case histories are obtained by members of the staff from the records of the local boards or directly from physicians in order to accumulate information in regard to the problems of each disease on which to base future recommendations for control. From time to time outbreaks of "food poisoning" occur and are likewise investigated.

Diphtheria Immunization. Members of the Division in cooperation with the staff of other Divisions keep in constant contact with the programs for diphtheria immunization of the various communities. When one community is found to be doing a particularly good job of immunizing children, information in regard to how the program is carried on is passed on to those communities in which the program is not so satisfactory. Every effort is made to assist each community in establishing a program which provides for the continuous adequate immunization of infants, preschool children, and children in the lower elementary grades of school, because it is well established that the case fatality is highest in these groups.

Board of Health Records. Frequently boards of health discover that they are unable to answer the questions which are asked because their records are not set up so that such answers are easily available. The assistance of our statistical division is always at the disposal of such communities, and workers are sent out to aid in setting up methods of record keeping which combine the advantages of simplicity and ready availability of information.

Rules and Regulations. The Division is being constantly called upon to aid local communities in formulating rules and regulations governing the administration of local health activities. During the year the bulletin of recommended regulations, first published in 1931, was revised and reissued. In it were included the rules and regulations in regard to camps which had been drawn up early in the year. Many communities in the State have been revising their regulations along the lines recommended by this bulletin. In Berkshire and Franklin Counties, a number of communities were able to publish these regulations jointly, thereby decreasing the cost of publication.

Milk Regulations. As the amount of pasteurized milk increases, it becomes less difficult for boards of health to pass regulations requiring the pasteurization or certification of all milk sold. Much time is spent by members of the Division discussing with local boards of health problems connected with the passage of these regulations. During the year Lawrence, Longmeadow, Nahant, Shirley, Wakefield, West Springfield, and Westfield were added to the list of those communities requiring pasteurization or certification. In addition, four communities, Brockton, Marblehead, Northbridge, and Pittsfield, have similar regulations which will become effective in the near future. Attleboro and Ludlow have also adopted the regulation but have not as yet decided upon the date of enforcement. This brings the total number on the list to 62, which represents 74 per cent of the population of the State. In addition, large quantities of pasteurized milk are sold in communities which have not as yet passed this regulation, and it is estimated that over 85 per cent of the milk sold in the State is now protected by pasteurization.

Nuisances. A certain amount of the time of workers in the Division is spent aiding local boards of health in finding the proper solution for various problems which are handled under the nuisance law. Frequently the unbiased opinion of someone from outside the community makes it much easier for the local board of health to obtain the proper action in matters of this kind. When district health officers are given additional personnel, such as sanitary inspectors, who can handle some of these details, more of the time of the district health officers can be released for solving the more important public health problems.

Local Town Unions

The Barnstable County Health Unit is being strengthened by assigning the full-time services of a nutritionist to work in this county. Undoubtedly, as the population at Camp Edwards brings in additional population to the surrounding communities, the responsibility thrown upon this Unit will increase and more assistance from the personnel of the State Department of Public Health will be needed to help them carry the burden of increased work.

The Nashoba Associated Boards of Health, directed by Dr. James O. Wails, has continued its good work as well as assumed a large share of the additional burden of solving problems arising out of the increased population at Fort Devens and the surrounding communities. The work thrown upon the staff is already beginning to increase and it may be necessary to find ways of augmenting the personnel in order that the further increase in work can be satisfactorily handled.

It has been increasingly apparent for some time that the Berkshire Health Unit would not be able to continue its present plan of organization. During the summer, three of the component organizations announced that they would withdraw from the Unit on December 31, 1940. The withdrawal of these groups has precipitated the dissolution of the organization, as the budget contributed by the remainder of the organizations would not be sufficient to carry on with the present personnel and those remaining in the organization would not be content to accept reduced services when their contributions would continue to be the same, nor would they want to increase their contributions in order that the services might be continued at the present level. On January 1, 1941, Dr. Frank B. Carroll will become full-time District Health Officer and will devote his time to all the communities in Berkshire County.

Plans are being completed to insure that many of the services which have been available through the Berkshire Unit will be provided in the future. Eight towns, including Great Barrington, have arranged to continue a generalized nursing service by subsidizing the Great Barrington Visiting Nurse Association. The Milk Control Laboratory at Lee has offered to examine the milk samples in this area for a nominal fee.

Reorganization of Districts

For some time a need has been apparent for the better organization of the functions of the Department in the eight districts under the supervision of district health officers. Such a reorganization is dependent upon increasing the personnel in each district in order to release more time of the district health officer for planning and carrying out programs for integrating the work of all the representatives of the Department who enter the districts.

For five years the North Connecticut Valley District has had the services of a milk and water laboratory, a milk inspector, and a full-time clerk. This has made it possible for Dr. Lee to carry on an increased amount of promotional work and formulate plans to further increase the effectiveness of the general work of the Department in his District. Mr. Doneilo has greatly improved the quality of the milk produced in the area by the education of the producers and has found time to lend assistance in nearby towns outside the District. A full-time nutritionist will be added to the staff in the near future.

Plans are now well under way for a more thorough reorganization of the Worcester District. Increased office space now makes it possible for all of the regularly assigned personnel to have desks in the District office and the services of an assistant district health officer, a sanitary officer, a nutritionist, and a clerk have been provided. With this added assistance, the activities of the District, under the supervision of Dr. Dudley, can be greatly augmented and much needed promotional work can be carried on.

Inspections, Licenses, and Approvals

Communicable Disease Hospitals. The district health officers have made the usual inspections of all the facilities available for the care of cases of communicable diseases in the hospitals in the State. Because of the continued decrease in the number of cases of communicable diseases which are being hospitalized, some communities are finding it more economical to close their communicable disease hospitals and are making arrangements with larger nearby hospitals for the care of their cases. During the year, the cities of Malden and Gardner closed their communicable disease hospitals.

Jails and Prisons. In connection with the annual inspection of jails and prisons, the district health officers filled out a sanitary survey of each institution. These surveys were turned over to the Division of Sanitary Engineering which took the responsibility of writing letters to certain of the prisons, calling attention to conditions which needed action on the part of local authorities. Similar surveys will be made in the future only when extensive repairs or remodeling are necessary.

Stations for Distributing Biological Products. The district health officers visited each station designated by local boards of health for the distribution of biologic products. The purpose of these inspections is to make sure that the products are being handled properly and that sufficient fresh supplies are kept on hand without gross overordering.

Dispensaries. Each dispensary licensed by the Department is inspected annually by the district health officers to determine that the rules and regulations of the Department are being properly carried out.

Approval of Bacteriological and Serological Laboratories. During the year the first certificates of approval were issued to laboratories complying with the rules and regulations laid down by the Department. A large group of laboratories will soon be receiving certificates. Many of them have already received notice that they have been approved for doing certain tests but the certificate itself will not be issued until a check is made upon all the tests for which approval has been requested, as the name of each test is to appear upon the face of the certificate and approval cannot be granted until checks of performance have been completed.

By the end of 1940 one hundred and three laboratories had made application for a certificate of approval for two or more tests. The progress in evaluating the performance on the various tests can be seen in the following table:

Kind of Test	Number of Laboratories Applying for Approval	Number Approved During 1940
Diphtheria: cultures	82	56
Diphtheria: virulence test	23	*
Dysentery, bacillary	33	*
Gonorrhea: smears	97	79
Malaria: smears	77	58
Meningitis: cultures	63	24
Pneumonia typing	92	49
Streptococcic sore throat: cultures	87	1
Syphilis: precipitation test	64	39
Tuberculosis: smears	98	63
Tuberculosis: cultures	16	*
Typhoid and paratyphoid: agglutination	39	*
Typhoid and paratyphoid: cultures	37	*
Typhus and Rocky Mountain spotted fever: agglutination	11	*
Undulant fever: agglutination	23	*

*Evaluation of performance not yet made.

This law has thrown a heavy burden of work upon this Division and the Division of Biologic Laboratories, but the Department feels well repaid, both because of the improvement in laboratory work which is resulting and because of the excellent co-operation on the part of the directors of local laboratories who have expressed approval of the manner in which the details have been handled by the Department.

Special Projects and Studies

Mosquito Survey. During the year the final tabulations of the material collected in the Mosquito Survey carried on in the summer and fall of 1939 were compiled by personnel assigned by the Work Projects Administration.

This survey demonstrated that there is not too much reason to be disturbed about the possibility of the spread of disease in this State by mosquitoes. More than 75 per cent of the specimens collected belonged to the genus *Culex* which does not transmit any diseases prevalent in this latitude. Over 10 per cent belonged to the genus *Anopheles* which once spread malaria in New England, but this disease has been practically absent from the State for several years. Less than 7 per cent of the total specimens belonged to the genus *Aedes* which can transmit the virus of the very fatal type of encephalitis in man and sleeping sickness in horses which occurred in Massachusetts in 1938. The survey has revealed the breeding places of these *Aedes* mosquitoes and, if the disease ever reappears in the State, we have information on file which will aid in directing control measures against the particular mosquitoes which can spread the disease.

Several exhibits have been prepared for meetings and fairs, so that many of the people of the State have become familiar with the results of the survey.

Scarlet Fever Immunization. The studies on the use of formalinized toxin which have been carried on as a joint project between this Division and the Division of Biologic Laboratories was continued during the year. Indications are that the product used for the first time in 1939 is somewhat more effective than that used previously, but there is some doubt as to whether a formalinized toxin can be made with sufficient antigenic content so that the Department will wish to sponsor distributing the product for generalized immunization of children. There is no doubt that much immunity is conferred but the efficacy does not as yet approach that which is secured with products in general use for immunization against diphtheria.

Pneumonia Studies. The work of the Department upon the study of the efficacy of therapeutic serum in pneumococcal pneumonia has been considerably affected by the recent introduction of chemotherapy. The number of cases treated with serum has necessarily decreased and the results in cases in which serum is used are no longer clear-cut because of the fact that the patients are usually simultaneously receiving serum and drug therapy. Such information as is available is still being collected in regard to serum-treated cases and it is expected that an analysis of these cases will aid in forming the basis of the future policy of the Department in regard to this problem.

The Division has continued to interest itself in the typing services available to local laboratories and has opened its laboratory for the training of those individuals who have had difficulties in satisfactorily performing Neufeld reactions and in doing blood cultures on pneumonia patients.

This work has been put upon a sounder basis because the Department is now authorized to grant certificates of approval to laboratories performing such tests. There has been a further increase in the number of laboratories prepared to type pneumococci through the complete list. Late in the year, typing serum for Type 33 was supplied to all approved laboratories. Numerous inquiries are answered in regard to technical procedures and thirty-four bacteriologists and technicians responsible for typing in local laboratories spent one or more days in the State Bacteriological Laboratory obtaining further experience in typing. The use of chemotherapy is beginning to affect the number of typings, particularly in the local laboratories, although the typings done in the Departmental laboratory decreased only slightly.

Early in the pneumonia season, therapeutic serum for three additional types was added to the list of those distributed without charge, so that at the present time therapeutic horse serum for Types 1, 2, 5, 7, and 8 is manufactured and distributed by the Department and therapeutic rabbit serum for Types 4, 9, 14 and 18 is purchased and distributed for treatment of cases on which the typing is done in an approved laboratory. In addition, therapeutic serums for the other higher types are also made available for pneumococcic infections verified by obtaining pneumococci from either the blood, spinal fluid, or peritoneal cavity.

The need for promotional work in connection with pneumonia has decreased very considerably due to the fact that both the public and the medical profession have become very well informed in regard to this disease. However, a number of talks on pneumonia were given to groups during the year, in many instances supplemented by showing the sound film "A New Day" made available by the Metropolitan Life Insurance Company.

Many inquiries continue to come to the Department in regard to problems connected with the treatment of pneumonia and an attempt is made to keep on file the latest information in regard to as many aspects of the subject as possible so that such inquiries can be satisfactorily answered.

Maternal Mortality and Other Statistical Studies. One epidemiologist continues to spend most of his time in the office of the Division of Vital Statistics accumulating information for studies of maternal mortality and extracting information for the use of the tuberculosis and cancer programs of the Department.

Exhibits. Much time and effort were devoted by two members of the Division to preparing material for exhibits at large meetings and fairs. These exhibits were built by commercial companies under careful direction and their general appearance reflected credit to the Department.

Educational Material. The usual popular pamphlets for distribution to the public were kept on hand and more technical material for the use of physicians and boards of health were prepared for distribution.

The Newsletter. This publication, prepared in the Division of Administration, has incorporated several interesting contributions from this Division. A number of favorable comments in regard to increased interest have been received.

Cooperation with Military Authorities

The plans to induct into service and train a large number of troops have thrown much work and responsibility upon this Division. District health officers have cooperated with local draft boards and have kept in constant touch with the military establishments within their districts.

The Division took considerable responsibility in aiding the U. S. Public Health Service to make a preliminary survey of the communities around Fort Devens and Camp Edwards. Voluminous information was collected and forwarded to the area office of the Public Health Service. Late in the year a resident representative was assigned to Boston by Surgeon General Parran and additional visits were made to the military establishments with this representative.

Problems connected with the reporting of communicable diseases and the typing of sputum from cases of pneumonia were discussed with surgeons in charge at the two camps as well as at Westover Field in Chicopee and working arrangements made.

Bacteriological Laboratory

During the year the Bacteriological Laboratory examined 50,092 specimens. The total number of examinations made on these specimens was 83,813. This is the largest number of specimens and examinations in the history of the laboratory. The number of specimens received for examination for the bacilli of enteric diseases remained high. This is due, principally, to thorough investigations made of contacts of cases of typhoid and paratyphoid fevers and dysentery.

Pneumococcus typing decreased to a level below that of 1939 but was still higher than in any other previous year. Specimens of sputum are examined for all types of pneumococci that may be present in a single specimen. One hundred fifty-two specimens were found to contain more than one type as follows: 128 specimens, 2 types; 18 specimens, 3 types; and 6 specimens, 4 types. Thirty-seven specimens contained pneumococci belonging to 4 types as yet unnumbered. The number of blood cultures sent for examination for pneumococci was small; a total of 153 was received, a decrease of 35 over the previous year.

The laboratory has continued to serve as a training center for pneumococcus typing. Thirty-four bacteriologists and technicians from approved laboratories came for training during the year.

Table I. — *Anterior Poliomyelitis*

Year	Cases	Case Rate per 100,000	Deaths	Death Rate per 100,000	Fatality Rate (Per Cent)
1936	51	1.2	8	0.2	15.7
1937	351	8.0	22	0.5	6.3
1938	18	0.4	7	0.1	38.9
1939	76	1.7	4	0.1	5.3
1940	45	1.0	2	0.04	4.4

Table II. — *Diphtheria*

Year	Cases	Case Rate per 100,000	Deaths	Death Rate per 100,000	Fatality Rate (Per Cent)
1936	307	7.0	27	0.6	8.8
1937	175	4.0	18	0.4	10.3
1938	159	3.6	19	0.4	11.9
1939	197	4.4	15	0.3	7.6
1940	144	3.3	8	0.2	5.6

Table III. — *Lobar Pneumonia*

Year	Cases	Case Rate per 100,000	Deaths	Death Rate per 100,000	Fatality Rate (Per Cent)
1936	5,459	124.6	1,944	44.4	35.6
1937	5,322	120.8	1,846	41.9	34.7
1938	4,296	97.1	1,312	29.6	30.5
1939	4,460	100.3	1,211	27.2	27.1
1940	4,332	100.4	925	21.4	21.4

Table IV. — *Measles*

Year	Cases	Case Rate per 100,000	Deaths	Death Rate per 100,000	Fatality Rate (Per Cent)
1936	28,111	641.4	35	0.8	0.1
1937	21,136	479.9	28	0.6	0.1
1938	10,533	238.0	13	0.3	0.1
1939	26,685	600.1	16	0.3	0.1
1940	21,698	502.6	11	0.3	0.1

Table V. — *Meningococcus Meningitis*

Year	Cases	Case Rate per 100,000	Deaths	Death Rate per 100,000	Fatality Rate (Per Cent)
1936	191	4.4	100	2.3	52.4
1937	166	3.8	72	1.6	43.4
1938	59	1.3	18	0.4	30.5
1939	48	1.1	17	0.4	35.4
1940	47	1.1	15	0.3	31.9

Table VI. — *Scarlet Fever*

Year	Cases	Case Rate per 100,000	Deaths	Death Rate per 100,000	Fatality Rate (Per Cent)
1936	8,774	200.2	44	1.0	0.5
1937	8,480	192.5	38	0.9	0.4
1938	10,146	229.3	24	0.5	0.2
1939	5,705	128.3	15	0.3	0.3
1940	5,277	122.2	19	0.4	0.4

Table VII. — *Tuberculosis, Pulmonary*

1936	3,207	73.2	1,733	39.5	
1937	3,534	80.2	1,761	40.0	
1938	3,220	72.8	1,536	34.7	
1939	2,959	66.5	1,505	33.8	
1940	2,816	65.2	1,484	34.4	

Table VIII. — *Tuberculosis, Nonpulmonary*

1936	401	9.1	165	3.8	
1937	363	8.2	126	2.9	
1938	375	8.5	139	3.1	
1939	310	7.0	97	2.2	
1940	294	6.8	114	2.6	

Table IX. — *Typhoid Fever*

1936	135	3.1	10	0.2	7.4
1937	114	2.6	13	0.3	11.4
1938	59	1.3	11	0.2	18.6
1939	78	1.7	11	0.2	14.1
1940	86	2.0	8	0.2	9.3

Table X. — *Whooping Cough*

1936	7,219	164.7	52	1.2	0.7
1937	13,333	302.7	95	2.1	0.7
1938	5,818	131.5	35	0.8	0.6
1939	7,548	169.7	45	1.0	0.6
1940	7,959	184.4	22	0.5	0.3

Table XI.—*Number and Kind of Examinations*

	1936	1937	1938	1939	1940
Diphtheria	5,575	6,104	6,923	7,104	6,614
Gonorrhea	11,714	13,621	12,725	12,942	13,070
Malaria	62	48	58	51	50
Pneumonia	1,446	1,950	3,602	3,965	3,608
Tuberculosis	5,631	5,186	6,392	6,479	7,565
Typhoid Fever:					
Widal	3,429	3,713	2,642	3,311	3,037
Culture	5,766	9,268	7,852	12,766	12,814
Undulant Fever	1,105	1,393	1,871	1,933	1,966
Miscellaneous	3,594	1,911	1,147	1,018	1,368
Total	38,322	43,194*	43,212*	49,569*	50,092*

*These figures represent the actual number of specimens; the figures for previous years are for the number of examinations counted in a different way than in Table XII.

Table XII.—*Specimens and Examinations for 1940*

	Positive	Negative	Total Number of Specimens	Total Number of Examinations
Diphtheria:				
Diagnosis	69	5,725	5,794	14,091 [1]
Release	210	610	820	820
Gonorrhea	1,735	11,335	13,070	26,140 [2]
Malaria	0	50	50	50
Meningococci, Spinal fluid for	–	37	37	74 [3]
Pneumonia:				
Pneumococci found and typed	1,650	–	1,650	1,650
Pneumococci not found	–	1,958	1,958	1,958
Tuberculosis:				
Sputum	922	5,898	6,820	6,820
Urine, spinal fluid, etc. (Culture and animal inoculations)	53	692	745	745
Typhoid Fever:				
Widal	112	2,925 [4]	3,037	6,498 [5]
Culture (blood, feces, urine, etc.)	382	12,432	12,814	17,609 [6]
Undulant Fever	133	1,863	1,996	5,988 [7]
Miscellaneous:				
Diphtheria virulence tests	17	6	23	23
Dysentery agglutination tests	1	122	123	123
Dysentery, Amoebic	–	46	46	46
Vincent's angina (sent by dentists)	445	208	653	653
Weil-Felix reaction for Rickettsial diseases	1	62	63	63
Unclassified	–	–	393	462 [8]
Total			50,092	83,813

[1] Includes examinations for hemolytic streptococci and the organisms of Vincent's angina.
[2] Includes examinations for average number of leucocytes per field.
[3] Includes examinations for influenza bacilli and other organisms.
[4] Includes 262 partial reactions.
[5] Includes 424 agglutination tests for paratyphoid A and 3,037 tests for paratyphoid B.
[6] Includes examinations for paratyphoid and dysentery bacilli.
[7] Includes examinations for agglutinins for typhoid and paratyphoid B.
[8] Includes miscellaneous examinations for identification of organisms.

Table XIII.—*Pneumococcus Type Differentiation*

Type	Number	Per Cent[1]	Type	Number	Per Cent[1]
1	198	10.8	21	30	1.6
2	38	2.1	22	32	1.7
3	235	12.8	23	48	2.6
4	63	3.4	24	18	1.0
5	49	2.7	25	14	0.8
6	86	4.7	27	11	0.6
7	81	4.4	28	26	1.4
8	126	6.9	29	53	2.9
9	47	2.6	31	23	1.3
10	56	3.1	32	5	0.3
11	62	3.4	33	28	1.5
12	17	0.9	Buckley	10	0.5
13	36	2.0	Carver	11	0.6
14	42	2.3	Dougherty	8	0.4
15	37	2.0	Reilly	8	0.4
16	38	2.1			
17	66	3.6	Typed pneumococci	1,832	100.0
18	44	2.4	No pneumococci	1,958	
19	95	5.2			
20	91	5.0	Total	3,790 [1]	

[1] 152 specimens with more than one type.

Table XIV. — *Laboratory Examinations for Rabies**

Year	Positive: Dogs	Positive: Other Animals	Negative	Total Animals Examined
1936	105	4	224	335
1937	158	6	247	460
1938	49	1	233	255
1939	31	1	264	304
1940	52	4	244	309

*Wassermann Laboratory.

Cases and Deaths, with Case and Death Rates per 100,000 Population[1] for Reportable Diseases During the Year 1940

Diseases	Cases	Case Rate per 100,000 Population	Deaths	Death Rate per 100,000 Population	Fatality Rate (Per Cent)
Actinomycosis	4	.1	4	.1	100.0
Anterior poliomyelitis	45	1.0	2	–[2]	4.4
Anthrax	8	.2	–	–	–
Chicken pox	12,859	297.9	2	–[2]	–[2]
Diphtheria	144	3.3	8	.2	5.6
Dog bite	11,021	255.3	1	–[2]	–[2]
Dysentery, Amebic	4	.1	1	–[2]	25.0
Dysentery, Bacillary	327	7.6	4	.1	1.2
German measles	557	12.9	–	–	–
Gonorrhea	4,014	93.0	3	.1	.1
Hookworm	–	–	–	–	–
Infectious encephalitis	13	.3	10	.2	76.9
Leprosy	1	–[2]	–	–	–
Lobar pneumonia	4,332	100.4	925	21.4	21.4
Malaria	7	.2	–	–	–
Measles	21,698	502.6	11	.3	.1
Meningococcus meningitis	47	1.1	15	.3	31.9
Mumps	6,261	145.0	3	.1	–[2]
Ophthalmia neonatorum	310	7.2	–	–	–
Paratyphoid A fever	–	–	–	–	–
Paratyphoid B fever	105	2.4	1	–[2]	1.0
Pellagra	13	.3	3	.1	23.1
Pfeiffer bacillus meningitis	11	.3	21	.5	–[3]
Rabies	–	–	–	–	–
Rocky Mountain spotted fever	–	–	–	–	–
Scarlet fever	5,277	122.2	19	.4	.4
Septic sore throat	214	5.0	30	.7	14.0
Smallpox	–	–	–	–	–
Suppurative conjuctivitis	560	13.0	–	–	–
Syphilis	5,024	116.4	340[4]	7.9	6.8
Tetanus	17	.4	10	.2	58.8
Trachoma	14	.3	–	–	–
Trichinosis	46	1.1	2	–[2]	4.3
Tuberculosis, Pulmonary	2,816	65.2	1,484	34.4	52.7
Tuberculosis, other forms	294	6.8	114	2.6	38.8
Tuberculosis, Hilum	181	4.2	–	–	–
Tularemia	–	–	–	–	–
Typhoid fever	86	2.0	8	.2	9.3
Typhus fever	–	–	–	–	–
Undulant fever	52	1.2	1	–[2]	1.9
Whooping cough	7,959	184.4	22	.5	.3
Total	84,321	1,953.4	3,044	70.5	

[1] Population 4,316,721.

[2] Less than .05.

[3] Incompletely reported.

[4] Includes deaths from general paralysis of the insane, locomotor ataxia, etc., not included in this classification in previous years.

Cases and Deaths for all Reportable Diseases by Months—1940

	Jan.		Feb.		March		April		May		June		July		August		September		October		November		December		Total	
	Cases	Deaths	Cases	Deaths	Cases	Deaths	Cases	Deaths	Cases	Deaths	Cases	Deaths	Cases	Deaths	Cases	Deaths	Cases	Deaths	Cases	Deaths	Cases	Deaths	Cases	Deaths	Cases	Deaths
Actinomycosis	–	–	–	1	–	–	1	1	–	–	–	–	–	–	–	–	1	1	1	–	1	1	–	–	4	4
Anterior poliomyelitis	2	–	2	–	1	–	–	–	1	–	2	–	3	–	9	2	14	–	7	–	4	–	–	–	45	2
Anthrax	–	–	–	–	–	–	–	–	–	–	1	–	2	–	1	–	1	–	1	–	–	–	2	–	8	–
Chicken pox	2328	1	1705	–	1471	–	1286	–	1207	–	851	–	384	–	81	–	105	–	491	–	1270	1	1680	–	12859	2
Diphtheria	31	4	13	1	7	1	11	–	11	–	6	–	7	–	12	1	7	–	20	1	10	–	9	–	144	8
Dog bite	582	–	630	–	727	–	907	–	1373	–	1249	1	1353	–	1168	–	955	–	845	–	641	–	591	–	11021	1
Dysentery, Amebic	–	–	–	–	1	–	–	–	–	–	1	–	–	–	–	–	1	1	–	–	1	–	–	–	4	1
Dysentery, Bacillary	35	–	41	1	36	1	24	1	15	–	11	–	97	–	15	–	17	–	21	–	12	–	3	1	327	4
German measles	36	–	60	–	56	–	56	–	109	–	64	–	30	–	20	–	18	–	26	–	34	–	48	–	557	–
Gonorrhea	342	1	291	–	308	–	368	–	313	1	292	1	335	–	366	–	391	–	374	–	340	–	294	–	4014	3
Hookworm	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Infectious enceph.	–	1	1	1	2	1	–	2	2	–	3	1	–	1	1	–	2	2	–	–	2	1	–	–	13	10
Leprosy	–	–	–	–	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–
Lobar pneumonia	623	109	579	135	609	109	521	120	386	62	225	51	183	45	91	23	135	37	219	57	354	72	407	105	4332	925
Malaria	–	–	1	–	–	–	3	–	–	–	–	–	–	–	–	–	1	–	–	–	2	–	–	–	7	–
Measles	962	–	1191	1	1486	–	2463	2	4058	2	5222	1	2830	4	506	–	211	–	619	1	985	–	1165	–	21698	11
Meningococcus men.	3	1	5	1	3	–	5	1	3	–	1	1	–	1	3	2	4	2	5	2	8	1	7	3	47	15
Mumps	562	1	668	–	866	–	756	–	943	–	641	–	358	–	157	1	125	1	199	–	389	–	597	–	6261	3
Ophthalmia neonatorum	40	–	49	–	115	–	102	–	142	–	42	–	59	–	60	–	102	–	75	–	47	–	37	–	870	–
Paratyphoid A	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Paratyphoid B	5	–	1	–	11	–	3	–	22	–	6	–	12	1	36	–	3	–	3	–	2	–	1	–	105	1
Pellagra	3	–	–	–	–	–	2	–	1	–	–	–	1	1	1	–	1	–	3	–	1	1	–	1	13	3
Pfeiffer bacillus men.	–	4	1	4	2	5	1	1	3	1	–	2	1	–	1	–	–	–	–	–	–	1	2	3	11	21
Rabies	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Rocky Mt. spotted fever	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Scarlet fever	565	1	509	8	608	–	756	1	670	2	379	–	196	1	77	–	128	–	266	1	481	1	642	4	5277	19
Septic sore throat	26	5	23	4	33	1	32	2	22	4	13	1	13	5	3	1	4	–	16	2	12	1	17	4	214	30
Smallpox	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Syphilis	431	36	405	19	501	28	479	30	518	32	389	18	424	31	297	33	403	22	394	30	407	29	376	32	5024	340
Tetanus	1	1	–	–	1	1	2	1	2	1	2	2	1	1	3	1	3	1	1	–	1	1	–	–	17	10
Trachoma	2	–	1	–	2	–	1	–	2	–	–	–	1	–	1	–	–	–	1	–	1	–	2	–	14	–
Trichinosis	1	–	1	1	4	–	1	–	5	–	12	–	2	–	4	–	2	–	5	1	8	–	1	–	46	2
Tuberculosis, Pulmonary	167	111	179	112	218	147	189	148	350	127	229	148	255	124	298	139	251	95	223	99	143	109	314	125	2816	1484
Tuberculosis, Other forms	21	5	30	7	20	12	19	11	31	15	24	13	18	10	25	6	32	8	30	14	16	11	28	2	294	114
Tuberculosis, Hilum	6	–	22	–	16	–	15	–	26	–	14	–	18	–	25	–	15	–	13	–	2	–	9	–	181	–
Tularemia	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Typhoid fever	8	1	5	1	3	1	10	–	16	2	7	1	3	–	11	–	5	1	6	–	6	–	6	1	86	8
Typhus fever	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Undulant fever	2	–	4	–	5	–	4	1	8	–	3	–	4	–	1	–	9	–	3	–	4	–	5	–	52	1
Whooping cough	625	–	532	4	644	–	625	2	757	2	579	1	521	2	508	–	474	–	645	3	888	5	1161	3	7959	22
Total	7409	282	6949	301	7757	307	8642	324	10996	251	10268	242	7111	227	3781	209	3420	171	4512	211	6072	235	7404	284	84321	3044

Cases of Reportable Diseases by Ages for 1940

Disease	Under 1 Year	1 year	2 years	3 years	4 years	5 years	6 years	7 years	8 years	9 years	10 to 14 years	15 to 19 years	20 to 24 years	25 to 29 years	30 to 39 years	40 to 49 years	50 to 59 years	60 to 69 years	70 years and over	Age Unknown	Total	Male	Female
Actinomycosis	–	–	–	–	–	–	–	–	–	–	1	–	–	–	1	–	1	–	1	–	4	3	1
Anterior poliomyelitis	1	3	3	1	1	4	2	2	4	3	12	8	–	1	–	–	–	–	–	–	45	31	14
Anthrax	–	–	–	–	–	–	–	–	–	–	–	–	1	2	1	2	1	1	–	–	8	8	–
Chicken pox	335	498	674	895	915	1588	2317	1674	1125	665	1292	226	90	51	65	19	1	3	–	426	12859	6633	6226
Diphtheria	2	11	10	11	18	7	14	10	11	5	15	8	3	4	12	2	1	–	–	–	144	80	64
Dysentery, Amebic	–	–	–	1	–	–	–	–	–	–	–	–	1	–	1	–	1	–	–	–	4	2	2
Dysentery, Bacillary	9	7	7	13	15	17	20	11	14	12	67	39	27	13	24	10	8	8	6	–	327	152	175
German measles	41	70	51	35	32	35	69	47	36	27	61	22	10	7	3	–	–	–	–	11	557	308	249
Gonorrhea	17	2	5	4	8	10	8	5	7	4	14	357	1167	1020	844	360	126	30	8	18	4014	3075	939
Hookworm	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Infectious encephalitis	1	3	–	–	–	–	1	–	1	–	1	–	3	–	–	2	1	–	–	–	13	10	3
Leprosy	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	–	–	–	1	1	–
Lobar pneumonia	154	122	90	94	81	87	97	90	61	57	165	182	167	206	475	484	541	536	521	122	4332	2650	1682
Malaria	1	–	–	–	–	–	–	–	–	–	–	1	–	4	–	–	–	1	–	–	7	5	2
Measles	619	1071	1467	1924	1828	2448	3500	3075	1983	1185	1378	371	137	84	85	13	4	4	3	519	21698	11110	10588
Meningococcus meningitis	11	3	3	1	4	1	2	1	3	2	1	2	1	2	3	3	3	1	–	–	47	23	24
Mumps	18	71	161	230	278	504	929	813	689	552	1174	259	115	55	115	43	10	3	6	236	6261	3447	2814
Paratyphoid A	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Paratyphoid B	4	2	2	2	1	1	1	1	2	3	2	17	19	3	11	4	12	9	9	–	105	79	26
Pellagra	–	–	–	–	–	–	–	–	–	–	–	–	–	–	2	4	2	2	3	–	13	9	4
Pfeiffer bacillus meningitis	3	4	–	1	–	–	1	1	–	1	–	–	–	–	–	–	–	–	–	–	11	4	7
Rabies	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Rocky Mountain spotted fever	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Scarlet fever	29	105	304	477	428	555	658	516	406	285	783	254	96	76	97	42	7	5	2	152	5277	2644	2633
Septic sore throat	–	6	5	5	5	4	5	6	7	1	21	32	27	18	35	14	16	5	2	–	214	102	112
Smallpox	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Syphilis	14	4	7	1	4	6	8	7	3	8	57	137	403	504	1107	1136	955	498	128	37	5024	2928	2096
Tetanus	2	1	1	–	1	–	–	–	–	–	3	1	1	1	2	1	1	2	–	–	17	17	–
Trachoma	–	–	–	–	–	–	1	–	–	1	1	–	–	2	2	2	2	2	1	–	14	13	1
Trichinosis	–	–	–	–	–	1	1	1	1	3	1	6	6	5	12	6	3	–	–	–	46	18	28
Tuberculosis, Pulmonary	5	3	7	4	8	4	3	2	5	7	47	177	323	311	467	438	361	263	104	277	2816	1649	1167
Tuberculosis, Other forms	4	7	6	6	4	4	3	1	2	3	23	26	28	23	53	31	24	16	11	19	294	138	156
Tuberculosis, Hilum	1	2	3	8	4	11	5	14	11	8	42	18	9	4	14	13	3	2	–	9	181	74	107
Tularemia	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Typhoid fever	–	2	2	2	6	3	2	4	2	4	6	10	7	7	16	6	3	4	–	–	86	50	36
Typhus fever	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Undulant fever	–	–	–	–	1	–	1	1	–	–	–	2	2	9	16	12	4	3	1	–	52	34	18
Whooping cough	643	655	835	940	883	900	1082	698	409	216	352	35	16	14	20	7	6	1	2	245	7959	3931	4028

Cases of Reportable Deseases By Counties—1940

	Barnstable	Berkshire	Bristol	Dukes	Essex	Franklin	Hampden	Hampshire	Middlesex	Nantucket	Norfolk	Plymouth	Suffolk	Worcester	Total
Actinomycosis	–	–	–	–	2	–	–	–	1	–	–	1	–	–	4
Anterior poliomyelitis	–	3	1	–	1	1	10	3	3	–	1	2	4	16	45
Anthrax	–	–	–	–	7	–	–	–	1	–	–	–	–	–	8
Chicken pox	111	204	438	–	905	106	657	153	3,943	–	1,386	416	3,000	1,540	12,859
Diphtheria	1	3	28	–	26	1	3	–	37	–	11	1	23	10	144
Dog bite	102	130	382	–	1,414	58	573	81	2,819	8	876	242	3,343	993	11,021
Dysentery, Amebic	–	–	–	–	–	–	–	1	–	–	–	2	–	1	4
Dysentery, Bacillary	–	8	5	–	38	4	6	35	81	–	21	2	23	104	327
German measles	7	4	38	–	93	4	27	15	126	–	42	18	102	81	557
Gonorrhea	32	61	315	2	413	37	348	34	636	7	204	141	1,554	230	4,014
Infectious encephalitis	–	–	–	–	4	1	4	–	2	–	–	1	–	1	13
Leprosy	–	–	–	–	–	–	–	–	1	–	–	–	–	–	1
Lobar pneumonia	14	50	147	–	512	24	357	100	1,028	–	364	132	961	643	4,332
Malaria	–	–	–	–	–	–	–	–	6	–	–	–	1	–	7
Measles	285	37	2,272	–	4,694	21	179	237	2,734	2	852	409	3,725	6,251	21,698
Meningococcus meningitis	2	2	–	–	7	2	2	1	13	–	2	4	5	7	47
Mumps	33	70	180	–	455	9	862	21	2,172	–	735	133	1,112	479	6,261
Ophthalmia neonatorum	5	1	96	–	114	–	55	8	72	–	3	105	336	75	870
Paratyphoid B fever	–	4	4	–	17	1	3	–	46	–	7	3	16	4	105
Pellagra	–	–	–	–	–	1	–	–	2	–	–	–	10	–	13
Pfeiffer bacillus meningitis	–	–	3	–	–	1	–	1	2	–	1	1	–	2	11
Scarlet fever	39	99	223	–	552	65	438	29	1,491	–	427	321	1,199	394	5,277
Septic sore throat	–	–	15	–	32	6	2	–	65	–	14	3	62	15	214
Syphilis	68	94	267	8	536	41	359	33	988	2	248	193	1,839	348	5,024
Tetanus	1	1	2	–	1	–	–	–	4	–	1	1	3	3	17
Trachoma	–	–	2	–	–	–	–	–	3	–	1	2	6	–	14
Trichinosis	–	–	2	–	7	5	–	1	18	–	4	–	7	2	46
Tuberculosis, Pulmonary	21	48	242	1	263	7	195	31	577	2	217	86	883	243	2,816
Tuberculosis, Other forms	–	3	24	–	43	1	10	3	67	–	15	5	95	28	294
Tuberculosis, Hilum	–	–	5	–	10	–	3	1	8	–	2	1	150	1	181
Typhoid fever	1	–	10	–	7	–	1	1	33	–	13	5	13	2	86
Undulant fever	1	6	3	–	5	2	3	1	5	–	2	4	2	18	52
Whooping cough	8	90	505	–	1,187	67	336	41	1,292	6	590	127	3,294	416	7,959
Total	731	918	5,209	11	11,345	465	4,433	831	18,276	27	6,039	2,361	21,768	11,907	84,321

Index to Line Numbers in the Table of Cases and Deaths from Diseases Dangerous to the Public Health, 1940

Cases and Deaths from Diseases

Line No.	Cities and Towns in Order of Population	Population Federal Census as of April 1, 1940	Anterior Poliomyelitis		Chicken Pox		Diphtheria		Dog Bite		German Measles		Gonorrhea	
			Cases	Deaths	Cases	Deaths	Cases	Deaths	Cases	Deaths	Cases	Deaths	Cases	Deaths
1	Massachusetts	4,316,721	45	2	12859	2	144	8	11021	1	557	–	4014	3
	Cities of over 500,000													
2	Boston	770,816	4	–	2903	–	16	2	2995	–	94	–	1467	–
	Cities of over 150,000													
3	Worcester	193,694	15	1	765	–	5	–	612	–	34	–	83	–
	Cities of 100,000–150,000 . . .	*689,768*	*4*	–	*1979*	–	*43*	*1*	*1451*	–	*55*	–	*733*	*2*
4	Springfield	149,554	3	–	459	–	–	–	279	–	11	–	232	–
5	Fall River	115,428	1	–	199	–	25	1	166	–	11	–	79	–
6	Cambridge	110,879	–	–	1021	–	7	–	512	–	11	–	100	–
7	New Bedford	110,341	–	–	113	–	1	–	104	–	15	–	169	–
8	Somerville	102,177	–	–	154	–	10	–	184	–	7	–	88	1
9	Lowell	101,389	–	–	33	–	–	–	206	–	–	–	65	1
	Cities of 50,000–100,000 . . .	*565,315*	*3*	*1*	*1674*	*1*	*13*	*2*	*1465*	–	*80*	–	*411*	–
10	Lynn	98,123	–	–	222	–	–	–	317	–	11	–	87	–
11	Lawrence	84,323	–	–	38	–	12	2	147	–	5	–	73	–
12	Quincy	75,810	–	–	353	–	–	–	175	–	12	–	54	–
13	Newton	69,873	–	–	461	–	–	–	227	–	17	–	44	–
14	Medford	63,083	–	–	184	–	–	–	180	–	7	–	35	–
15	Brockton	62,343	1	–	211	–	–	–	109	–	9	–	45	–
16	Malden	58,010	–	–	192	1	1	–	210	–	11	–	48	–
17	Holyoke	53,750	2	1	13	–	–	–	100	–	8	–	25	–
	Cities and Towns of 25,000–50,000 .	*623,963*	*3*	–	*1473*	*1*	*19*	–	*1612*	–	*102*	–	*461*	–
18	Brookline	49,786	–	–	132	–	–	–	135	–	8	–	38	–
19	Pittsfield	49,684	–	–	20	–	2	–	60	–	2	–	33	–
20	Everett	46,784	–	–	27	–	–	–	82	–	7	–	52	–
21	Haverhill	46,752	–	–	75	–	–	–	163	–	9	–	58	–
22	Fitchburg	41,824	–	–	27	1	1	–	21	–	1	–	30	–
23	Chicopee	41,664	3	–	26	–	2	–	72	–	2	–	22	–
24	Chelsea	41,259	–	–	23	–	6	–	150	–	4	–	42	–
25	Salem	41,213	–	–	78	–	–	–	79	–	37	–	26	–
26	Waltham	40,020	–	–	99	–	2	–	106	–	–	–	21	–
27	Arlington	40,013	–	–	236	–	1	–	165	–	5	–	7	–
28	Taunton	37,395	–	–	4	–	1	–	5	–	–	–	19	–
29	Watertown	35,427	–	–	98	–	1	–	132	–	6	–	28	–
30	Revere	34,405	–	–	33	–	1	–	138	–	2	–	31	–
31	Belmont	26,867	–	–	518	–	–	–	153	–	11	–	10	–
32	Beverly	25,537	–	–	25	–	1	–	85	–	5	–	28	–
33	Melrose	25,333	–	–	52	–	1	–	66	–	3	–	16	–
	Cities and Towns of 10,000–25,000 .	*726,127*	*5*	–	*1980*	–	*29*	1	*1871*	–	*92*	–	*450*	1
34	Northampton	24,794	1	–	129	–	–	–	43	–	11	–	15	–
35	Gloucester	24,046	–	–	14	–	–	–	94	–	–	–	21	–
36	Weymouth	23,868	–	–	10	–	–	–	48	–	–	–	19	–
37	Framingham	23,214	–	–	136	–	11	–	111	–	2	–	15	1
38	Leominster	22,226	–	–	17	–	–	–	46	–	1	–	9	–
39	North Adams	22,213	1	–	4	–	–	–	35	–	–	–	4	–
40	Attleboro	22,071	–	–	38	–	–	–	68	–	7	–	11	–
41	Methuen	21,880	–	–	47	–	7	–	36	–	–	–	7	–
42	Peabody	21,711	–	–	91	–	–	–	49	–	–	–	23	–
43	Gardner	20,206	–	–	10	–	–	–	61	–	2	–	5	–
44	Woburn	19,751	–	–	6	–	–	–	2	–	–	–	11	–
45	Westfield	18,793	–	–	18	–	–	–	42	–	2	–	23	–
46	Milton	18,708	–	–	132	–	–	–	44	–	1	–	6	–
47	West Springfield	17,135	–	–	40	–	–	–	43	–	1	–	21	–
48	Southbridge	16,825	–	–	8	–	–	–	4	–	–	–	8	–
49	Winthrop	16,768	–	–	41	–	–	–	60	–	2	–	14	–
50	Braintree	16,378	1	–	175	–	–	–	97	–	4	–	10	–
51	Wakefield	16,223	–	–	4	–	–	–	48	–	1	–	12	–
52	Greenfield	15,672	1	–	34	–	–	–	46	–	1	–	16	–
53	Dedham	15,508	–	–	1	–	–	–	3	–	–	–	8	–
54	Milford	15,388	–	–	10	–	–	–	26	–	–	–	10	–
55	Norwood	15,383	–	–	6	–	–	–	26	–	–	–	17	–
56	Marlborough	15,154	–	–	19	–	–	–	–	–	–	–	4	–
57	Wellesley	15,127	–	–	222	–	2	–	106	–	7	–	8	–
58	Winchester	15,081	1	–	1	–	–	–	50	–	9	–	9	–
59	Saugus	14,825	–	–	9	–	1	1	57	–	7	–	9	–
60	Danvers	14,179	–	–	17	–	3	–	14	–	5	–	4	–
61	Newburyport	13,916	–	–	114	–	–	–	31	–	1	–	11	–
62	Natick	13,851	–	–	151	–	–	–	97	–	5	–	9	–
63	Lexington	13,187	–	–	47	–	–	–	61	–	3	–	5	–

Lobar Pneumonia		Measles		Menin. Meningitis		Mumps		Ophthalmia Neonatorum		Scarlet Fever		Syphilis		Tuberculosis, Pulmonary		Tuberculosis, Other Forms		Typhoid Fever		Whooping Cough		
Cases	Deaths	Cases	Deaths	Cases	Deaths	Cases	Deaths	Cases	Deaths	Cases	Deaths	Cases	Deaths	Cases	Deaths	Cases	Deaths	Cases	Deaths	Cases	Deaths	Line No.
4332	925	21698	11	47	15	6261	3	870	–	5277	19	5024	340	2816	1434	294	114	86	8	7959	22	1
846	255	3643	–	4	3	986	1	326	–	1139	5	1716	66	841	468	88	39	12	1	3128	7	2
304	56	3275	–	2	–	177	–	71	–	227	1	161	19	141	56	15	5	1	–	179	–	3
585	*112*	*2390*	*4*	*4*	*1*	*1454*	*1*	*188*	–	*732*	*3*	*810*	*70*	*442*	*258*	*47*	*17*	*24*	*2*	*947*	*7*	
151	24	104	–	1	1	716	–	52	–	206	–	227	17	71	42	4	1	1	–	183	–	4
70	16	1295	4	–	–	75	–	59	–	78	1	66	8	70	44	10	5	–	–	356	2	5
171	19	138	–	2	–	511	–	25	–	152	–	224	12	98	47	11	6	2	–	236	1	6
36	12	597	–	–	–	10	1	31	–	35	1	106	12	105	55	5	3	3	–	44	2	7
100	17	66	–	–	–	139	–	4	–	231	1	112	7	52	33	10	1	17	2	102	1	8
57	24	190	–	1	–	3	–	17	–	30	–	75	14	46	37	7	1	1	–	26	1	9
705	*127*	*3005*	–	*10*	*4*	*1214*	–	*120*	–	*937*	*4*	*578*	*39*	*351*	*175*	*33*	*18*	*16*	*1*	*1208*	*2*	
101	27	1358	–	1	–	37	–	9	–	196	–	132	14	60	32	12	4	1	–	744	2	10
32	16	607	–	–	–	70	–	1	–	27	1	91	5	61	28	5	3	1	–	21	–	11
161	25	236	–	2	1	207	–	–	–	136	–	59	3	58	25	3	1	8	1	117	–	12
71	12	198	–	–	–	260	–	2	–	75	1	69	2	26	21	4	2	–	–	74	–	13
95	10	160	–	2	–	216	–	2	–	110	–	61	4	24	9	4	2	1	–	67	–	14
74	17	66	–	3	1	61	–	101	–	138	–	62	4	26	15	–	1	3	–	46	–	15
77	11	371	–	1	2	359	–	5	–	235	1	69	3	45	20	2	1	2	–	105	–	16
94	9	9	–	1	–	4	–	–	–	20	1	35	4	51	25	3	4	–	–	34	–	17
689	*119*	*2497*	*2*	*5*	*2*	*767*	–	*25*	–	*515*	*1*	*621*	*45*	*346*	*160*	*49*	*12*	*6*	–	*752*	*2*	
30	12	214	–	–	–	183	–	1	–	34	1	54	4	32	10	3	–	–	–	192	–	18
14	7	23	–	1	–	31	–	1	–	15	–	20	5	20	13	2	1	–	–	10	–	19
54	11	257	–	–	–	38	–	2	–	50	–	60	2	30	14	1	–	–	–	53	–	20
61	3	593	–	–	–	53	–	3	–	85	–	76	9	25	12	6	2	–	–	34	–	21
42	11	427	1	1	1	13	–	–	–	11	–	22	1	20	13	2	–	–	–	6	–	22
39	5	3	–	–	–	4	–	1	–	19	–	36	5	27	8	1	1	–	–	15	–	23
52	15	36	–	1	–	87	–	8	–	31	–	63	6	23	19	4	2	1	–	60	1	24
52	7	297	1	–	–	2	–	–	–	23	–	42	2	17	10	3	1	–	–	36	–	25
58	10	196	–	–	–	37	–	–	–	50	–	54	2	34	8	1	1	3	–	63	–	26
46	5	51	–	–	–	66	–	2	–	29	–	20	3	24	7	5	–	2	–	33	–	27
7	10	6	–	–	1	–	–	1	–	10	–	34	2	26	15	1	2	–	–	5	–	28
40	13	56	–	–	–	53	–	–	–	67	–	38	1	20	7	6	1	–	–	12	–	29
46	5	31	–	–	–	20	–	1	–	11	–	45	–	15	11	3	1	–	–	80	–	30
25	–	42	–	–	–	159	–	1	–	35	–	18	–	10	3	2	–	–	–	47	–	31
89	2	229	–	2	–	6	–	–	–	24	–	18	2	14	5	7	–	–	–	63	1	32
34	3	36	–	–	–	15	–	4	–	21	–	21	1	9	5	2	–	–	–	43	–	33
605	*100*	*2847*	*1*	*11*	*3*	*668*	–	*117*	–	*924*	*2*	*551*	*40*	*329*	*177*	*35*	*9*	*14*	*1*	*880*	*3*	
42	2	98	–	–	–	4	–	8	–	4	–	19	1	13	10	2	–	–	–	4	–	34
32	3	4	–	2	–	3	–	92	–	4	–	40	2	14	10	1	1	–	–	6	–	35
36	–	6	–	–	–	5	–	–	–	9	–	15	2	15	2	1	–	4	–	5	–	36
19	2	61	–	1	–	42	–	–	–	32	–	24	2	10	2	1	–	1	–	145	–	37
29	5	269	–	–	–	55	–	–	–	7	–	14	3	8	6	1	2	–	–	–	–	38
13	–	–	–	1	–	1	–	–	–	25	–	29	1	13	6	1	–	–	–	13	1	39
12	3	110	–	–	–	7	–	3	–	62	–	16	1	7	6	1	–	–	–	31	–	40
5	4	309	–	1	–	55	–	1	–	17	1	15	1	19	2	1	–	–	–	10	–	41
17	2	345	–	–	–	2	–	–	–	35	–	29	1	12	6	3	–	1	1	22	–	42
30	5	75	–	–	–	1	–	1	–	9	–	13	1	8	6	1	1	–	–	11	–	43
2	6	14	–	–	–	4	–	–	–	9	–	13	3	1	5	2	–	2	–	6	–	44
21	–	5	–	–	–	18	–	1	–	15	–	14	–	13	4	–	1	–	–	5	–	45
9	4	17	–	–	–	26	–	–	–	62	–	13	–	6	4	1	–	–	–	37	–	46
18	5	17	–	–	–	28	–	–	–	36	–	14	3	7	4	–	–	–	–	3	–	47
14	6	273	–	–	–	4	–	1	–	3	–	8	–	4	1	–	–	–	–	17	–	48
17	2	15	–	–	1	19	–	1	–	18	–	15	2	4	6	–	–	–	–	26	1	49
18	4	30	–	–	–	74	–	–	–	27	–	15	2	6	1	–	–	–	–	67	–	50
24	1	32	–	–	–	16	–	–	–	13	–	6	1	8	5	–	–	–	–	7	–	51
10	3	7	–	–	–	7	–	–	–	18	–	17	–	3	3	–	–	–	–	44	–	52
2	2	2	–	–	–	5	–	–	–	30	–	8	2	8	5	–	–	–	–	3	–	53
15	3	60	–	2	2	4	–	2	–	4	–	15	1	7	10	1	1	–	–	1	–	54
8	1	1	–	–	–	6	–	1	–	12	–	9	1	6	4	1	–	1	–	3	–	55
3	2	4	–	–	–	–	–	–	–	7	–	14	2	8	8	–	–	1		5	–	56
15	1	108	–	–	–	18	–	–	–	28	–	7	1	4	2	–	–	–	–	13	–	57
6	–	16	–	–	–	71	–	–	–	64	–	9	–	2	2	3	–	–	–	10	–	58
17	4	110	–	–	–	39	–	2	–	19	–	7	–	4	–	2	–	–	–	35	1	59
17	6	83	–	–	–	1	–	–	–	34	–	9	1	2	–	–	–	–	–	–	–	60
14	1	29	–	–	–	3	–	–	–	4	–	11	–	3	7	–	–	–	–	2	–	61
9	1	46	–	1	–	15	–	–	–	198	1	10	–	2	3	–	–	–	–	62	–	62
17	1	63	–	–	–	3	–	–	–	8	–	2	1	31	5	2	–	1	–	3	–	63

Cases and Deaths from Diseases

Line No.	Cities and Towns in Order of Population	Population Federal Census as of April 1, 1940	Anterior Poliomyelitis		Chicken Pox		Diphtheria		Dog Bite		German Measles		Gonorrhea	
			Cases	Deaths	Cases	Deaths	Cases	Deaths	Cases	Deaths	Cases	Deaths	Cases	Deaths
64	Webster	13,186	–	–	53	–	–	–	10	–	–	–	8	–
65	Plymouth	13,100	–	–	14	–	–	–	30	–	4	–	5	–
66	Adams	12,608	–	–	13	–	1	–	3	–	–	–	5	–
67	Needham	12,445	–	–	147	–	–	–	75	–	4	–	5	–
68	Clinton	12,440	–	–	4	–	–	–	17	–	–	–	2	–
69	Athol	11,180	–	–	6	–	–	–	–	–	–	–	12	–
70	Andover	11,122	–	–	15	–	1	–	45	–	1	–	4	–
71	Fairhaven	10,938	–	–	3	–	–	–	2	–	–	–	13	–
72	Reading	10,866	–	–	24	–	1	–	12	–	–	–	6	–
73	Amesbury	10,862	–	–	17	–	–	–	39	–	–	–	15	–
74	Marblehead	10,856	–	–	55	–	–	–	82	–	2	–	11	–
75	Stoneham	10,765	–	–	33	–	–	–	62	–	1	–	6	–
76	Swampscott	10,761	–	–	37	–	–	–	46	–	7	–	4	–
77	North Attleborough	10,359	–	–	2	–	1	–	–	–	–	–	3	–
78	Easthampton	10,316	–	–	4	–	–	–	–	–	1	–	2	–
79	Northbridge	10,242	–	–	2	–	1	–	–	–	–	–	5	–
	Cities and Towns of 5,000–10,000	*336,769*	*3*	–	*996*	–	*9*	*2*	*458*	–	*23*	–	*184*	–
80	Palmer	9,149	–	–	22	–	–	–	4	–	–	–	2	–
81	Middleborough	9,032	–	–	76	–	–	–	9	–	1	–	3	–
82	Dartmouth	9,011	–	–	34	–	–	–	12	–	–	–	8	–
83	Bridgewater	8,902	–	–	57	–	–	–	19	–	1	–	5	–
84	Stoughton	8,632	–	–	4	–	–	–	2	–	–	–	5	–
85	Barnstable	8,333	–	–	2	–	–	–	30	–	2	–	6	–
86	Ludlow	8,181	–	–	8	–	–	–	1	–	–	–	6	–
87	Rockland	8,087	–	–	1	–	–	–	2	–	–	–	5	–
88	Chelmsford	8,077	1	–	3	–	–	–	11	–	–	–	2	–
89	Hudson	8,042	–	–	–	–	–	–	–	–	–	–	4	–
90	Hingham	8,003	–	–	1	–	–	–	1	–	1	–	3	–
91	Concord	7,972	–	–	37	–	–	–	17	–	–	–	2	–
92	Billerica	7,933	–	–	16	–	1	–	39	–	–	–	2	–
93	Agawam	7,842	–	–	–	–	–	–	–	–	–	–	7	–
94	Whitman	7,759	–	–	–	–	–	–	1	–	–	–	7	–
95	Randolph	7,634	–	–	–	–	–	–	–	–	–	–	4	–
96	Shrewsbury	7,586	–	–	5	–	–	–	–	–	–	–	2	–
97	Montague	7,582	–	–	–	–	–	–	8	–	–	–	1	–
98	Ware	7,557	–	–	12	–	–	–	–	–	–	–	3	–
99	North Andover	7,524	–	–	25	–	–	–	24	–	–	–	2	–
100	Grafton	7,457	–	–	10	–	1	–	1	–	–	–	3	–
101	Walpole	7,443	–	–	27	–	–	–	4	–	1	–	7	–
102	Dracut	7,339	–	–	–	–	–	–	–	–	–	–	–	–
103	Franklin	7,303	–	–	37	–	–	–	42	–	–	–	2	–
104	Millbury	6,983	1	–	148	–	–	–	20	–	1	–	–	–
105	Falmouth	6,878	–	–	20	–	–	–	45	–	2	–	11	–
106	South Hadley	6,856	–	–	–	–	–	–	14	–	–	–	4	–
107	Maynard	6,812	–	–	13	–	–	–	–	–	–	–	–	–
108	Spencer	6,641	–	–	8	–	–	–	12	–	1	–	3	–
109	Auburn	6,629	–	–	54	–	1	–	7	–	–	–	2	–
110	Winchendon	6,575	–	–	10	–	–	–	21	–	6	–	4	–
111	Mansfield	6,530	–	–	22	–	–	–	11	–	3	–	2	–
112	Westborough	6,463	–	–	105	–	1	1	20	–	1	–	1	–
113	Uxbridge	6,417	–	–	34	–	–	–	13	–	–	–	3	–
114	Amherst	6,410	–	–	3	–	–	–	14	–	1	–	3	–
115	Canton	6,381	–	–	19	–	2	1	19	–	–	–	5	–
116	Wareham	6,364	1	–	–	–	–	–	4	–	1	–	32	–
117	Ipswich	6,348	–	–	14	–	–	–	1	–	–	–	4	–
118	Foxborough	6,303	–	–	8	–	1	–	2	–	–	–	2	–
119	Tewksbury	6,261	–	–	1	–	–	–	5	–	–	–	1	–
120	Somerset	5,873	–	–	7	–	–	–	–	–	–	–	1	–
121	Great Barrington	5,824	–	–	90	–	–	–	9	–	–	–	4	–
122	Longmeadow	5,790	–	–	41	–	–	–	7	–	1	–	2	–
123	Abington	5,708	–	–	1	–	1	–	–	–	–	–	3	–
124	Orange	5,611	–	–	1	–	–	–	–	–	–	–	3	–
125	Monson	5,597	–	–	11	–	1	–	–	–	–	–	–	–
126	Easton	5,135	–	–	9	–	–	–	7	–	–	–	3	–
	Towns of 2,500–5,000	*216,362*	*2*	–	*599*	–	*7*	–	*319*	*1*	*26*	–	*115*	–
127	Seekonk	4,912	–	–	–	–	–	–	–	–	–	–	1	–
128	Leicester	4,851	–	–	1	–	–	–	–	–	–	–	4	–
129	Swansea	4,684	–	–	–	–	–	–	–	–	–	–	1	–
130	Wrentham	4,674	–	–	75	–	5	–	12	–	–	–	2	–
131	Wilmington	4,645	–	–	–	–	–	–	–	–	–	–	3	–
132	Oxford	4,623	–	–	54	–	–	–	15	–	–	–	2	–
133	Dudley	4,616	–	–	–	–	–	–	2	–	–	–	1	–
134	Templeton	4,601	–	–	–	–	–	–	5	–	–	–	–	–

Dangerous to the Public Health, 1940—Continued

Lobar Pneumonia		Measles		Menin. Meningitis		Mumps		Ophthalmia Neonatorum		Scarlet Fever		Syphilis		Tuberculosis, Pulmonary		Tuberculosis, Other Forms		Typhoid Fever		Whooping Cough		
Cases	Deaths	Cases	Deaths	Cases	Deaths	Cases	Deaths	Cases	Deaths	Cases	Deaths	Cases	Deaths	Cases	Deaths	Cases	Deaths	Cases	Deaths	Cases	Deaths	Line No.
4	–	206	1	–	–	–	–	–	–	8	–	9	1	2	3	2	–	–	–	8	–	64
1	–	11	–	–	–	3	–	–	–	21	–	21	–	7	2	3	1	–	–	5	–	65
3	1	3	–	–	–	–	–	–	–	17	–	1	–	5	4	–	1	–	–	–	–	66
8	1	17	–	–	–	52	–	–	–	6	–	10	2	4	2	1	–	–	–	57	–	67
6	1	1	–	–	–	–	–	–	–	7	–	4	–	2	3	–	–	–	–	–	–	68
12	3	4	–	–	–	–	–	–	–	1	–	9	–	4	1	–	–	–	–	–	–	69
3	2	54	–	–	–	46	–	–	–	9	–	10	–	6	2	–	–	–	–	74	–	70
3	1	1	–	–	–	1	–	–	–	4	–	9	–	6	6	1	–	–	–	1	–	71
13	1	157	–	2	–	1	–	–	–	9	–	4	–	5	–	–	–	–	–	29	–	72
11	1	3	–	–	–	6	–	–	–	5	–	4	–	3	3	1	–	–	–	3	–	73
10	3	97	–	–	–	7	–	2	–	5	–	15	–	7	2	–	–	–	–	9	–	74
6	2	4	–	–	–	6	–	–	–	3	–	6	–	7	1	–	–	–	–	14	–	75
5	1	79	–	1	–	5	–	2	–	13	–	5	1	7	2	1	–	2	–	84	–	76
–	–	–	–	–	–	–	–	–	–	1	–	10	1	3	1	1	–	1	–	–	–	77
25	–	–	–	–	–	1	–	–	–	–	–	2	–	8	7	–	–	–	–	–	–	78
4	4	1	–	–	–	4	–	–	–	2	–	2	–	5	3	–	1	–	–	–	–	79
308	*68*	*1335*	*1*	*5*	*1*	*427*	–	*6*	–	*470*	*1*	*261*	*27*	*160*	*91*	*17*	*5*	*5*	*2*	*387*	–	
8	–	5	–	–	–	10	–	1	–	110	–	5	–	3	1	1	–	–	–	4	–	80
1	2	47	–	–	–	2	–	2	–	62	–	11	3	1	2	–	1	1	–	1	–	81
6	3	92	–	–	–	6	–	2	–	1	–	2	–	2	2	2	–	–	–	1	–	82
21	–	33	–	–	–	3	–	–	–	4	–	10	2	12	5	1	–	–	–	49	–	83
3	1	13	–	–	–	47	–	–	–	11	–	4	1	8	5	1	1	–	–	26	–	84
2	–	31	–	–	–	7	–	–	–	9	–	10	–	3	1	–	–	–	–	1	–	85
2	3	6	–	–	–	7	–	–	–	14	–	8	1	5	6	–	–	–	–	58	–	86
7	–	–	–	–	–	3	–	–	–	4	–	3	1	2	1	–	–	–	–	–	–	87
6	3	13	–	–	–	–	–	–	–	1	–	2	–	4	3	–	–	–	–	2	–	88
1	2	–	–	–	–	–	–	–	–	1	–	5	2	2	4	–	–	–	–	–	–	89
4	–	–	–	–	–	4	–	–	–	21	–	3	–	1	2	–	–	–	–	–	–	90
3	2	7	–	–	–	27	–	–	–	5	–	9	–	–	–	1	–	–	–	13	–	91
6	1	61	–	–	–	–	–	–	–	13	–	9	–	1	–	1	–	–	–	13	–	92
5	2	–	–	–	–	–	–	–	–	2	–	3	1	1	2	–	–	–	–	–	–	93
5	2	2	–	–	–	1	–	–	–	7	–	2	1	3	2	–	–	–	–	–	–	94
3	5	–	–	–	–	–	–	–	–	4	–	5	–	5	4	–	–	–	–	2	–	95
20	3	82	–	–	–	4	–	–	–	10	–	3	–	–	1	–	–	–	–	–	–	96
–	–	1	–	–	–	1	–	–	–	12	–	12	–	–	1	1	–	–	–	1	–	97
–	2	15	–	–	–	3	–	–	–	17	–	2	1	–	1	–	–	–	–	–	–	98
1	1	89	1	–	–	15	–	–	–	24	–	2	–	1	1	–	–	1	1	1	–	99
36	2	36	–	–	–	3	–	–	–	–	–	3	–	13	1	1	–	–	–	3	–	100
9	2	27	–	–	–	39	–	–	–	12	–	3	–	1	2	–	–	–	–	–	–	101
1	3	–	–	–	–	–	–	–	–	–	–	–	–	–	4	–	–	–	–	–	–	102
22	2	33	–	–	–	1	–	–	–	1	–	7	–	7	1	–	–	–	–	31	–	103
14	1	214	–	1	1	–	–	–	–	5	–	3	1	1	2	2	–	–	–	51	–	104
6	–	5	–	1	–	6	–	–	–	7	–	28	–	2	1	–	–	–	–	–	–	105
5	1	2	–	–	–	1	–	–	–	1	–	4	–	3	1	–	–	1	1	–	–	106
–	2	–	–	–	–	4	–	–	–	–	–	2	–	2	5	–	–	–	–	–	–	107
8	–	98	–	–	–	–	–	–	–	16	1	5	–	2	2	–	–	–	–	–	–	108
15	1	167	–	–	–	20	–	–	–	18	–	3	1	3	1	–	–	–	–	5	–	109
2	1	2	–	–	–	2	–	–	–	1	–	5	–	1	–	1	–	–	–	1	–	110
3	1	5	–	–	–	26	–	–	–	4	–	2	1	1	4	1	–	–	–	11	–	111
10	–	18	–	–	–	2	–	–	–	9	–	1	1	1	–	–	–	–	–	3	–	112
5	3	96	–	1	–	96	–	–	–	4	–	5	–	3	1	–	–	1	–	2	–	113
12	4	3	–	–	–	1	–	–	–	–	–	2	–	1	1	1	–	–	–	22	–	114
10	2	9	–	–	–	33	–	–	–	3	–	3	–	5	–	–	1	–	–	11	–	115
2	–	73	–	–	–	–	–	1	–	12	–	27	5	14	1	–	–	–	–	3	–	116
13	2	8	–	–	–	–	–	–	–	2	–	5	–	4	1	1	–	–	–	7	–	117
7	–	4	–	–	–	13	–	–	–	5	–	2	3	13	–	1	–	–	–	1	–	118
1	3	6	–	–	–	1	–	–	–	–	–	8	–	2	–	–	–	–	–	1	–	119
–	1	14	–	–	–	–	–	–	–	10	–	3	–	3	6	–	–	1	–	8	–	120
2	1	–	–	–	–	9	–	–	–	–	–	15	1	2	4	–	–	–	–	8	–	121
2	1	4	–	–	–	19	–	–	–	7	–	6	–	2	1	–	–	–	–	18	–	122
1	2	–	–	–	–	–	–	–	–	5	–	3	–	4	3	–	–	–	–	–	–	123
5	1	1	–	2	–	–	–	–	–	10	–	–	–	1	2	–	2	–	–	3	–	124
5	–	11	–	–	–	5	–	–	–	1	–	1	1	12	1	–	–	–	–	–	–	125
8	–	2	–	–	–	6	–	–	–	5	–	5	–	3	2	1	–	–	–	26	–	126
130	*41*	*1250*	*3*	*4*	*1*	*322*	*1*	*5*	–	*187*	*1*	*163*	*15*	*90*	*54*	*7*	*4*	*7*	*1*	*258*	*1*	
–	2	–	–	–	–	–	–	–	–	–	–	1	–	1	2	–	1	–	–	–	–	127
1	–	1	–	–	–	–	–	–	–	2	–	2	–	1	2	–	–	–	–	–	–	128
2	–	12	–	–	–	–	–	–	–	–	1	5	–	4	2	–	–	–	–	2	–	129
3	3	40	–	–	–	12	–	–	–	5	–	2	–	13	4	3	–	–	–	1	–	130
6	–	23	–	1	–	12	–	–	–	7	–	3	2	2	2	–	–	–	–	2	–	131
6	–	98	–	–	–	15	–	–	–	6	–	2	–	–	–	–	–	–	–	6	–	132
1	–	2	–	–	–	–	–	–	–	1	–	1	–	2	2	–	–	–	–	–	–	133
3	2	–	–	–	–	–	–	–	–	–	–	3	–	–	1	1	1	–	–	–	–	134

Line No.	Cities and Towns in Order of Population	Population Federal Census as of April 1, 1940	Anterior Poliomyelitis		Chicken Pox		Diphtheria		Dog Bite		German Measles		Gonorrhea	
			Cases	Deaths	Cases	Deaths	Cases	Deaths	Cases	Deaths	Cases	Deaths	Cases	Deaths
135	Blackstone	4,566	–	–	–	–	–	–	–	–	–	–	–	–
136	Medfield	4,384	–	–	–	–	–	–	4	–	–	–	–	–
137	Williamstown	4,294	–	–	6	–	–	–	–	–	–	–	1	–
138	Lee	4,222	–	–	33	–	–	–	11	–	1	–	7	–
139	Dalton	4,206	–	–	–	–	–	–	–	–	–	–	–	–
140	Acushnet	4,145	–	–	–	–	–	–	1	–	–	–	3	–
141	Westport	4,134	–	–	3	–	–	–	2	–	1	–	1	–
142	Scituate	4,130	–	–	–	–	–	–	–	–	–	–	4	–
143	Holden	3,924	–	–	48	–	–	–	12	1	1	–	2	–
144	East Bridgewater	3,832	–	–	–	–	–	–	20	–	–	–	6	–
145	Westford	3,830	–	–	13	–	–	–	2	–	–	–	–	–
146	Bedford	3,807	–	–	9	–	–	–	6	–	–	–	1	–
147	Sharon	3,737	–	–	–	–	–	–	25	–	–	–	3	–
148	Provincetown	3,668	–	–	76	–	–	–	2	–	–	–	1	–
149	Weston	3,590	–	–	5	–	–	–	8	–	1	–	–	–
150	Ayer	3,572	–	–	31	–	–	–	4	–	3	–	2	–
151	Rockport	3,556	–	–	–	–	–	–	21	–	–	–	3	–
152	Warren	3,531	–	–	3	–	–	–	8	–	2	–	3	–
153	Barre	3,528	–	–	2	–	–	–	1	–	–	–	10	–
154	Wayland	3,505	–	–	3	–	–	–	10	–	–	–	1	–
155	Belchertown	3,503	–	–	4	–	–	–	2	–	2	–	–	–
156	East Longmeadow	3,403	1	–	2	–	–	–	13	–	–	–	1	–
157	Nantucket	3,401	–	–	–	–	–	–	8	–	–	–	7	–
158	Westwood	3,376	–	–	2	–	–	–	12	–	–	–	–	–
159	Holbrook	3,330	–	–	1	–	–	–	19	–	1	–	2	–
160	Bourne	3,315	–	–	3	–	–	–	5	–	3	–	3	–
161	North Brookfield	3,304	–	–	6	–	–	–	7	–	–	–	3	–
162	Medway	3,297	–	–	–	–	–	–	–	–	–	–	2	–
163	West Bridgewater	3,247	–	–	3	–	–	–	–	–	1	–	4	–
164	Pepperell	3,114	–	–	–	–	–	–	1	–	–	–	5	–
165	Hopedale	3,113	–	–	12	–	–	–	1	–	2	–	–	–
166	Cohasset	3,111	–	–	23	–	1	–	20	–	2	–	1	–
167	Norton	3,107	–	–	2	–	–	–	4	–	1	–	–	–
168	Wilbraham	3,041	–	–	2	–	–	–	9	–	2	–	5	–
169	Holliston	3,000	–	–	3	–	–	–	3	–	–	–	1	–
170	Dighton	2,983	–	–	2	–	–	–	–	–	–	–	–	–
171	Bellingham	2,979	–	–	–	–	–	–	1	–	–	–	–	–
172	Lancaster	2,963	–	–	1	–	–	–	–	–	1	–	1	–
173	North Reading	2,886	–	–	2	–	–	–	2	–	–	–	1	–
174	Lenox	2,884	–	–	–	–	–	–	3	–	–	–	2	–
175	Hanover	2,875	–	–	–	–	–	–	8	–	–	–	–	–
176	Kingston	2,783	–	–	3	–	–	–	–	–	–	–	–	–
177	Sutton	2,749	–	–	–	–	–	–	–	–	–	–	–	–
178	Rehoboth	2,736	–	–	–	–	–	–	–	–	–	–	1	–
179	Acton	2,701	–	–	14	–	–	–	10	–	–	–	–	–
180	Hopkinton	2,697	–	–	59	–	–	–	7	–	–	–	–	–
181	Deerfield	2,684	–	–	7	–	–	–	1	–	–	–	3	–
182	Douglas	2,617	–	–	1	–	–	–	–	–	1	–	1	–
183	Shirley	2,608	–	–	63	–	1	–	8	–	1	–	2	–
184	Hadley	2,576	1	–	–	–	–	–	–	–	–	–	1	–
185	Hanson	2,570	–	–	11	–	–	–	–	–	–	–	3	–
186	Charlton	2,557	–	–	–	–	–	–	–	–	–	–	2	–
187	Groton	2,550	–	–	11	–	–	–	4	–	–	–	–	–
188	Harwich	2,535	–	–	–	–	–	–	–	–	–	–	2	–
	Towns of 1,000–2,500	*159,534*	*4*	–	*409*	–	*2*	–	*214*	–	*48*	–	*76*	–
189	Ashland	2,479	1	–	10	–	–	–	4	–	–	–	3	–
190	Manchester	2,472	–	–	–	–	–	–	–	–	–	–	2	–
191	Marshfield	2,419	–	–	7	–	–	–	–	–	–	–	1	–
192	Northborough	2,382	–	–	–	–	–	–	–	–	1	–	–	–
193	Salisbury	2,376	–	–	–	–	–	–	27	–	–	–	7	–
194	Duxbury	2,359	–	–	16	–	–	–	–	–	–	–	1	–
195	Middleton	2,348	–	–	–	–	–	–	–	–	–	–	1	–
196	Avon	2,335	–	–	4	–	–	–	5	–	–	–	1	–
197	Merrimac	2,320	–	–	–	–	–	–	7	–	1	–	2	–
198	Norfolk	2,294	–	–	–	–	–	–	–	–	2	–	–	–
199	Lynnfield	2,287	1	–	–	–	–	–	10	–	1	–	2	–
200	Yarmouth	2,286	–	–	–	–	–	–	10	–	–	–	1	–
201	Millis	2,278	–	–	4	–	–	–	–	–	–	–	1	–
202	Burlington	2,275	–	–	3	–	–	–	2	–	–	–	4	–
203	Ashburnham	2,255	–	–	–	–	–	–	1	–	2	–	–	–
204	Upton	2,249	–	–	14	–	–	–	4	–	–	–	–	–
205	Southborough	2,231	–	–	9	–	–	–	2	–	–	–	3	–
206	Sturbridge	2,227	–	–	2	–	1	–	–	–	2	–	2	–
207	Hatfield	2,216	–	–	–	–	–	–	2	–	–	–	–	–

Dangerous to the Public Health, 1940—Continued

Lobar Pneumonia		Measles		Menin. Meningitis		Mumps		Ophthalmia Neonatorum		Scarlet Fever		Syphilis		Tuberculosis, Pulmonary		Tuberculosis, Other Forms		Typhoid Fever		Whooping Cough		
Cases	Deaths	Cases	Deaths	Cases	Deaths	Cases	Deaths	Cases	Deaths	Cases	Deaths	Cases	Deaths	Cases	Deaths	Cases	Deaths	Cases	Deaths	Cases	Deaths	Line No.
–	1	–	–	–	–	–	–	–	–	–	–	2	–	–	2	–	–	–	–	–	–	135
2	–	1	–	–	–	–	–	–	–	1	–	2	–	5	–	–	–	–	–	6	–	136
1	–	6	–	–	–	12	–	–	–	32	–	3	–	–	–	–	–	–	–	37	–	137
2	1	1	–	–	–	1	–	–	–	1	–	6	1	1	2	–	–	–	–	9	–	138
–	1	–	–	–	–	–	–	–	–	4	–	2	–	2	–	–	–	–	–	–	–	139
–	–	–	–	–	–	–	–	–	–	1	–	1	–	3	4	1	–	–	–	–	–	140
–	–	103	–	–	–	48	–	–	–	–	–	4	–	–	–	–	–	–	–	19	–	141
1	1	–	–	–	–	–	–	–	–	3	–	6	–	1	–	–	–	–	–	–	–	142
7	–	61	–	–	–	1	–	–	–	5	–	3	–	3	–	–	–	–	–	1	–	143
5	1	8	–	–	–	43	–	–	–	3	–	5	1	2	1	–	–	–	–	2	–	144
1	1	55	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	145
3	–	12	–	–	–	–	–	–	–	–	–	3	3	–	–	–	–	–	–	5	1	146
4	–	85	–	–	–	1	1	–	–	5	–	8	–	–	–	–	–	–	–	–	–	147
2	–	214	–	–	–	3	–	5	–	–	–	3	–	4	–	–	–	1	–	–	–	148
4	1	3	–	–	–	20	–	–	–	1	–	5	–	6	1	–	–	–	–	2	–	149
11	–	11	1	–	–	1	–	–	–	3	–	2	–	2	1	–	–	–	–	2	–	150
1	1	2	–	–	–	2	–	–	–	3	–	2	3	1	4	–	1	1	–	–	–	151
6	2	5	–	–	–	2	–	–	–	5	–	–	1	–	–	–	–	–	–	17	–	152
6	1	25	–	–	–	–	–	–	–	–	–	–	–	3	1	–	–	–	–	2	–	153
3	1	33	1	–	–	18	–	–	–	3	–	5	–	1	–	–	–	–	–	12	–	154
2	–	35	–	–	–	–	–	–	–	2	–	–	–	4	2	–	–	–	–	9	–	155
1	–	2	–	–	–	–	–	–	–	2	–	2	–	–	1	–	–	–	–	–	–	156
–	–	2	–	–	–	–	–	–	–	–	–	2	1	2	–	–	–	–	–	6	–	157
1	1	1	–	–	–	4	–	–	–	1	–	7	–	–	–	–	–	–	–	3	–	158
3	1	2	–	–	–	4	–	–	–	–	–	–	–	2	–	–	–	–	–	–	–	159
2	–	17	–	–	–	3	–	–	–	13	–	3	–	–	1	–	–	–	–	2	–	160
1	–	46	–	–	–	–	–	–	–	6	–	1	–	2	1	–	–	–	–	2	–	161
–	–	2	–	–	–	2	–	–	–	5	–	4	–	1	1	–	–	–	–	–	–	162
1	–	8	–	–	–	2	–	–	–	2	–	2	–	–	–	–	–	–	–	1	–	163
–	–	–	–	–	–	–	–	–	–	–	–	6	–	–	–	–	–	–	–	–	–	164
2	–	15	–	–	–	–	–	–	–	2	–	2	–	–	–	–	–	–	–	7	–	165
4	2	2	–	–	–	–	–	–	–	–	–	3	–	2	–	–	–	–	–	2	–	166
–	–	31	–	–	–	–	–	–	–	10	–	1	–	2	–	–	–	5	1	1	–	167
2	–	2	–	–	–	47	–	–	–	3	–	2	–	1	–	–	–	–	–	15	–	168
8	3	15	–	–	–	–	–	–	–	13	–	2	–	–	1	–	–	–	–	10	–	169
–	–	4	1	–	–	1	–	–	–	2	–	–	–	2	1	–	–	–	–	–	–	170
–	–	–	–	–	–	–	–	–	–	1	–	2	–	2	1	–	–	–	–	–	–	171
–	–	2	–	–	–	55	–	–	–	1	–	7	1	–	1	–	–	–	–	32	–	172
2	–	2	–	1	–	–	–	–	–	–	–	1	–	1	1	–	–	–	–	4	–	173
–	–	1	–	–	–	–	–	–	–	3	–	4	–	2	–	–	–	–	–	1	–	174
–	–	–	–	–	–	5	–	–	–	–	–	1	–	2	3	–	–	–	–	–	–	175
1	–	–	–	–	–	–	–	–	–	4	–	1	–	1	–	–	–	–	–	3	–	176
3	1	–	–	–	–	–	–	–	–	–	–	5	–	–	–	–	1	–	–	–	–	177
–	2	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	178
1	1	3	–	–	–	–	–	–	–	–	–	2	–	1	2	–	–	–	–	6	–	179
1	2	1	–	–	–	1	–	–	–	5	–	1	–	–	1	1	–	–	–	6	–	180
1	–	–	–	–	–	1	–	–	–	7	–	2	–	1	1	–	–	–	–	14	–	181
2	1	228	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	182
3	3	17	–	–	–	3	–	–	–	–	–	–	–	1	1	–	–	–	–	7	–	183
3	1	–	–	1	–	–	–	–	–	1	–	1	–	–	–	–	–	–	–	–	–	184
3	1	–	–	–	–	1	–	–	–	4	–	5	–	2	–	1	–	–	–	2	–	185
2	3	–	–	–	–	–	–	–	–	6	–	6	1	–	1	–	–	–	–	–	–	186
–	–	11	–	–	–	2	–	–	–	3	–	2	–	1	–	–	–	–	–	–	–	187
–	–	–	–	1	1	–	–	–	–	–	–	5	1	1	–	–	–	–	–	–	–	188
116	*42*	*1415*	–	*1*	–	*216*	–	*2*	–	*128*	*1*	*129*	*17*	*47*	*47*	*3*	*4*	*1*	–	*188*	–	
–	–	79	–	–	–	1	–	–	–	–	–	1	–	1	1	1	1	–	–	19	–	189
2	1	1	–	–	–	–	–	–	–	2	–	3	–	–	–	–	–	–	–	–	–	190
–	–	6	–	–	–	1	–	–	–	4	–	5	–	–	2	–	–	–	–	–	–	191
2	–	2	–	–	–	–	–	–	–	2	–	–	–	–	–	–	–	–	–	–	–	192
3	1	3	–	–	–	–	–	–	–	1	–	3	–	1	1	–	–	–	–	–	–	193
1	1	2	–	–	–	1	–	1	–	10	–	5	–	–	–	–	–	–	–	1	–	194
2	1	–	–	–	–	–	–	–	–	–	–	1	1	–	1	–	–	–	–	–	–	195
2	–	–	–	–	–	2	–	–	–	5	–	2	–	1	2	–	–	–	–	–	–	196
3	–	80	–	–	–	95	–	–	–	–	–	1	–	–	–	–	–	–	–	3	–	197
4	–	2	–	–	–	–	–	–	–	8	–	–	–	11	–	–	–	–	–	–	–	198
–	–	6	–	–	–	1	–	–	–	1	–	–	–	–	1	–	–	–	–	24	–	199
1	–	1	–	–	–	–	–	–	–	1	–	–	1	–	–	–	–	–	–	–	–	200
–	–	–	–	–	–	–	–	1	–	–	–	1	–	1	–	–	–	–	–	3	–	201
–	–	1	–	–	–	4	–	–	–	1	–	6	2	1	–	–	–	–	–	–	–	202
3	1	51	–	–	–	1	–	–	–	–	–	1	–	1	3	–	–	–	–	–	–	203
3	–	1	–	–	–	4	–	–	–	7	–	–	–	–	–	–	–	–	–	1	–	204
4	1	1	–	–	–	1	–	–	–	1	–	–	–	–	1	–	–	–	–	1	–	205
–	–	90	–	–	–	2	–	–	–	4	–	4	–	–	–	–	–	–	–	–	–	206
4	2	83	–	–	–	–	–	–	–	4	–	–	–	1	4	–	1	–	–	–	–	207

Cases and Deaths from Diseases

Line No.	Cities and Towns in Order of Population	Population Federal Census as of April 1, 1940	Anterior Poliomyelitis		Chicken Pox		Diphtheria		Dog Bite		German Measles		Gonorrhea	
			Cases	Deaths	Cases	Deaths	Cases	Deaths	Cases	Deaths	Cases	Deaths	Cases	Deaths
208	Lunenburg	2,195	–	–	7	–	–	–	3	–	–	–	–	–
209	Rutland	2,181	–	–	–	–	–	–	2	–	–	–	1	–
210	Hull	2,167	–	–	1	–	–	–	23	–	–	–	2	–
211	Hardwick	2,154	–	–	47	–	–	–	7	–	7	–	–	–
212	Raynham	2,141	–	–	–	–	–	–	–	–	–	–	–	–
213	Chatham	2,136	–	–	1	–	–	–	–	–	–	–	–	–
214	Westminster	2,126	–	–	–	–	–	–	–	–	–	–	–	–
215	Groveland	2,122	–	–	–	–	–	–	3	–	–	–	1	–
216	Townsend	2,065	–	–	23	–	–	–	–	–	15	–	–	–
217	Hamilton	2,037	–	–	–	–	–	–	2	–	–	–	–	–
218	Marion	2,030	–	–	1	–	–	–	10	–	–	–	3	–
219	Dennis	2,015	–	–	8	–	–	–	4	–	–	–	1	–
220	Northfield	1,975	–	–	21	–	–	–	3	–	–	–	–	–
221	Tisbury	1,966	–	–	–	–	–	–	–	–	–	–	1	–
222	Norwell	1,871	–	–	12	–	–	–	–	–	–	–	2	–
223	Nahant	1,835	–	–	4	–	–	–	7	–	–	–	–	–
224	West Boylston	1,822	–	–	4	–	–	–	–	–	1	–	–	–
225	Stockbridge	1,815	1	–	20	–	–	–	3	–	–	–	2	–
226	Georgetown	1,803	–	–	–	–	–	–	12	–	–	–	1	–
227	Harvard	1,790	–	–	15	–	–	–	5	–	–	–	–	–
228	Lincoln	1,783	–	–	–	–	–	–	–	–	–	–	2	–
229	Lakeville	1,780	–	–	–	–	–	–	2	–	–	–	1	–
230	Sudbury	1,754	–	–	–	–	–	–	5	–	–	–	–	–
231	Millville	1,722	–	–	–	–	–	–	–	–	–	–	1	–
232	Pembroke	1,718	–	–	–	–	–	–	–	–	–	–	1	–
233	Sterling	1,713	–	–	2	–	–	–	5	–	–	–	–	–
234	Sheffield	1,709	–	–	1	–	–	–	1	–	–	–	–	–
235	Cheshire	1,708	–	–	–	–	–	–	–	–	–	–	–	–
236	Williamsburg	1,684	–	–	–	–	–	–	3	–	–	–	1	–
237	Littleton	1,651	–	–	103	–	–	–	–	–	–	–	–	–
238	Shelburne	1,636	–	–	–	–	–	–	–	–	–	–	2	–
239	Tyngsboro	1,634	–	–	3	–	–	–	2	–	–	–	–	–
240	Mattapoisett	1,608	–	–	–	–	–	–	–	–	–	–	2	–
241	Newbury	1,599	–	–	–	–	–	–	–	–	–	–	–	–
242	Freetown	1,584	–	–	–	–	–	–	–	–	–	–	–	–
243	Oak Bluffs	1,584	–	–	–	–	–	–	–	–	–	–	1	–
244	Southwick	1,579	–	–	–	–	–	–	2	–	–	–	–	–
245	Rowley	1,533	–	–	–	–	–	–	10	–	–	–	5	–
246	Buckland	1,527	–	–	–	–	–	–	–	–	–	–	2	–
247	West Newbury	1,515	–	–	1	–	–	–	–	–	–	–	–	–
248	Colrain	1,497	–	–	–	–	–	–	–	–	–	–	1	–
249	Carver	1,469	–	–	–	–	–	–	2	–	–	–	2	–
250	Orleans	1,451	–	–	1	–	–	–	1	–	–	–	–	–
251	Brookfield	1,393	–	–	7	–	–	–	8	–	1	–	2	–
252	Boylston	1,388	–	–	–	–	–	–	–	–	–	–	–	–
253	West Brookfield	1,387	–	–	7	–	–	–	8	–	12	–	–	–
254	Essex	1,384	–	–	–	–	–	–	–	–	–	–	1	–
255	Dover	1,374	–	–	4	–	–	–	–	–	–	–	2	–
256	Edgartown	1,370	–	–	–	–	–	–	–	–	–	–	–	–
257	Sandwich	1,360	–	–	–	–	1	–	–	–	–	–	–	–
258	Huntington	1,340	–	–	–	–	–	–	–	–	–	–	1	–
259	Erving	1,328	–	–	–	–	–	–	–	–	–	–	–	–
260	Lanesborough	1,321	–	–	–	–	–	–	–	–	1	–	–	–
261	Clarksburg	1,317	–	–	–	–	–	–	–	–	–	–	–	–
262	Mendon	1,315	–	–	–	–	–	–	–	–	–	–	1	–
263	Plainville	1,302	–	–	–	–	–	–	–	–	–	–	–	–
264	Chester	1,284	–	–	1	–	–	–	–	–	–	–	–	–
265	Rochester	1,269	–	–	–	–	–	–	–	–	–	–	1	–
266	Stow	1,243	–	–	19	–	–	–	–	–	–	–	1	–
267	Russell	1,242	1	–	11	–	–	–	1	–	–	–	–	–
268	Hinsdale	1,235	–	–	–	–	–	–	–	–	–	–	–	–
269	Wenham	1,220	–	–	7	–	–	–	–	–	–	–	–	–
270	Topsfield	1,150	–	–	–	–	–	–	1	–	1	–	–	–
271	Berkley	1,130	–	–	–	–	–	–	–	–	–	–	–	–
272	Sunderland	1,085	–	–	–	–	–	–	–	–	–	–	–	–
273	Granby	1,085	–	–	–	–	–	–	–	–	–	–	–	–
274	West Stockbridge	1,062	–	–	–	–	–	–	–	–	–	–	–	–
275	Berlin	1,057	–	–	3	–	–	–	–	–	–	–	–	–
276	Ashby	1,026	–	–	3	–	–	–	–	–	–	–	–	–
277	Hampden	1,023	–	–	–	–	–	–	–	–	–	–	1	–
278	Sherborn	1,022	–	–	–	–	–	–	–	–	–	–	–	–
279	Hubbardston	1,022	–	–	–	–	–	–	–	–	–	–	–	–
280	East Brookfield	1,016	–	–	3	–	–	–	5	–	1	–	–	–
281	Brimfield	1,012	–	–	–	–	–	–	–	–	–	–	–	–

Dangerous to the Public Health, 1940—Continued

Lobar Pneumonia		Measles		Menin. Meningitis		Mumps		Ophthalmia Neonatorum		Scarlet Fever		Syphilis		Tuberculosis, Pulmonary		Tuberculosis, Other Forms		Typhoid Fever		Whooping Cough		Line No.
Cases	Deaths	Cases	Deaths	Cases	Deaths	Cases	Deaths	Cases	Deaths	Cases	Deaths	Cases	Deaths	Cases	Deaths	Cases	Deaths	Cases	Deaths	Cases	Deaths	
1	–	27	–	–	–	4	–	–	–	–	–	2	–	–	–	–	–	–	–	–	–	208
2	1	48	–	–	–	–	–	–	–	–	–	6	1	1	10	–	–	–	–	–	–	209
1	–	14	–	1	–	2	–	–	–	3	–	1	–	2	–	–	–	–	–	6	–	210
4	–	4	–	–	–	1	–	–	–	1	–	–	–	1	–	–	–	–	–	–	–	211
–	–	–	–	–	–	–	–	–	–	–	–	1	–	2	–	–	–	–	–	–	–	212
–	–	1	–	–	–	6	–	–	–	–	–	–	–	3	1	–	–	–	–	1	–	213
2	2	47	–	–	–	–	–	–	–	–	–	2	–	–	1	–	–	–	–	–	–	214
2	1	75	–	–	–	3	–	–	–	3	–	6	–	–	–	–	–	–	–	–	–	215
1	1	101	–	–	–	62	–	–	–	–	–	1	–	–	–	–	–	–	–	1	–	216
5	1	20	–	–	–	2	–	–	–	8	–	1	–	–	–	–	–	–	–	–	–	217
1	–	125	–	–	–	1	–	–	–	1	–	2	–	1	–	–	–	–	–	–	–	218
–	–	7	–	–	–	4	–	–	–	6	1	4	–	2	–	–	–	–	–	–	–	219
1	–	5	–	–	–	–	–	–	–	–	–	1	–	–	2	–	–	–	–	1	–	220
–	–	–	–	–	–	–	–	–	–	–	–	2	–	1	–	–	–	–	–	–	–	221
1	–	8	–	–	–	–	–	–	–	1	–	3	–	–	–	–	–	–	–	7	–	222
–	1	5	–	–	–	1	–	–	–	2	–	2	1	–	–	–	–	–	–	4	–	223
2	–	25	–	–	–	2	–	–	–	–	–	–	–	–	–	–	–	–	–	4	–	224
2	–	–	–	–	–	–	–	–	–	2	–	2	–	–	–	–	–	–	–	2	–	225
4	–	191	–	–	–	–	–	–	–	5	–	2	1	1	–	–	–	–	–	–	–	226
–	–	–	–	–	–	–	–	–	–	–	–	3	–	–	–	–	1	–	–	20	–	227
1	–	–	–	–	–	–	–	–	–	–	–	1	2	–	1	–	–	–	–	–	–	228
1	–	3	–	–	–	–	–	–	–	7	–	3	–	1	–	–	–	–	–	1	–	229
3	3	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	230
–	–	–	–	–	–	–	–	–	–	–	–	1	–	1	1	–	–	–	–	–	–	231
–	1	–	–	–	–	–	–	–	–	1	–	2	–	–	–	–	–	–	–	–	–	232
3	1	6	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	–	–	–	–	233
–	–	–	–	–	–	–	–	–	–	–	–	5	–	–	–	–	–	–	–	–	–	234
1	–	–	–	–	–	–	–	–	–	–	–	2	–	–	–	–	–	–	–	–	–	235
2	–	–	–	–	–	–	–	–	–	–	–	2	–	–	–	–	–	–	–	–	–	236
2	–	5	–	–	–	–	–	–	–	–	–	1	–	–	1	–	–	–	–	5	–	237
–	–	–	–	–	–	–	–	–	–	1	–	1	–	1	–	–	–	–	–	–	–	238
2	3	55	–	–	–	1	–	–	–	–	–	–	–	–	–	–	–	–	–	24	–	239
–	–	1	–	–	–	–	–	–	–	–	–	1	2	–	1	–	–	1	–	–	–	240
–	–	7	–	–	–	–	–	–	–	–	–	1	–	–	–	–	–	–	–	–	–	241
–	–	–	–	–	–	–	–	–	–	–	–	1	2	2	–	–	–	–	–	–	–	242
–	–	–	–	–	–	–	–	–	–	–	–	4	–	–	–	–	–	–	–	–	–	243
5	–	–	–	–	–	1	–	–	–	–	–	1	–	–	–	–	–	–	–	1	–	244
1	–	2	–	–	–	–	–	–	–	1	–	1	–	1	1	–	–	–	–	–	–	245
–	–	–	–	–	–	–	–	–	–	1	–	1	–	–	–	–	–	–	–	–	–	246
–	–	–	–	–	–	–	–	–	–	–	–	1	–	–	–	–	–	–	–	–	–	247
2	–	–	–	–	–	–	–	–	–	3	–	–	–	1	–	–	–	–	–	–	–	248
–	2	–	–	–	–	–	–	–	–	1	–	4	2	–	2	–	–	–	–	–	–	249
–	–	1	–	–	–	2	–	–	–	–	–	1	–	–	1	–	–	–	–	2	–	250
2	–	19	–	–	–	1	–	–	–	1	–	2	1	–	–	–	–	–	–	3	–	251
2	–	–	–	–	–	–	–	–	–	–	–	1	–	–	–	–	–	–	–	–	–	252
1	–	69	–	–	–	–	–	–	–	–	–	1	1	1	–	–	–	–	–	–	–	253
4	–	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	3	–	254
–	–	–	–	–	–	1	–	–	–	16	–	3	–	–	–	–	–	–	–	10	–	255
–	–	–	–	–	–	–	–	–	–	–	–	2	–	–	1	–	1	–	–	–	–	256
1	–	–	–	–	–	–	–	–	–	3	–	2	–	1	2	–	–	–	–	2	–	257
2	1	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	–	–	–	–	–	258
1	1	1	–	–	–	–	–	–	–	–	–	1	–	–	–	–	–	–	–	4	–	259
–	2	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	260
–	–	–	–	–	–	–	–	–	–	–	–	1	–	–	–	–	–	–	–	–	–	261
–	2	–	–	–	–	–	–	–	–	–	–	1	–	–	–	–	–	–	–	–	–	262
–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	–	–	–	–	–	–	263
2	1	–	–	–	–	–	–	–	–	–	–	–	–	1	–	1	–	–	–	–	–	264
–	–	2	–	–	–	–	–	–	–	1	–	3	–	2	–	–	–	–	–	–	–	265
–	–	30	–	–	–	–	–	–	–	3	–	2	–	–	–	–	–	–	–	14	–	266
–	1	–	–	–	–	3	–	–	–	1	–	–	–	1	–	–	–	–	–	–	–	267
–	1	1	–	–	–	3	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	268
–	1	2	–	–	–	–	–	–	–	–	–	1	–	–	–	–	–	–	–	–	–	269
3	1	2	–	–	–	1	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	270
–	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	271
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	2	–	–	–	–	–	–	272
–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	–	–	–	–	–	–	273
7	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	274
1	–	36	–	–	–	2	–	–	–	1	–	1	–	–	1	–	–	–	–	17	–	275
1	–	27	–	–	–	–	–	–	–	2	–	–	–	–	–	–	–	–	–	2	–	276
–	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	277
1	1	1	–	–	–	–	–	–	–	2	–	–	–	–	–	–	–	–	–	–	–	278
1	2	–	–	–	–	–	–	–	–	–	–	–	–	–	2	–	–	–	–	–	–	279
–	–	32	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	280
1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	281

Cases and Deaths from Diseases

Line No.	Cities and Towns in Order of Population	Population Federal Census as of April 1, 1940	Anterior Poliomyelitis		Chicken Pox		Diphtheria		Dog Bite		German Measles		Gonorrhea	
			Cases	Deaths	Cases	Deaths	Cases	Deaths	Cases	Deaths	Cases	Deaths	Cases	Deaths
	Towns under 1,000	*34,373*	2	–	81	–	*1*	–	*24*	–	*3*	–	*19*	–
282	Whately	979	–	–	–	–	–	–	–	–	–	–	–	–
283	New Marlborough	956	–	–	1	–	–	–	1	–	–	–	–	–
284	Bernardston	954	–	–	–	–	–	–	–	–	–	–	–	–
285	Southampton	950	–	–	–	–	–	–	–	–	–	–	1	–
286	Conway	944	–	–	5	–	–	–	–	–	–	–	2	–
287	Gill	931	–	–	11	–	–	–	–	–	2	–	1	–
288	Petersham	923	–	–	2	–	–	–	–	–	–	–	–	–
289	Wellfleet	890	–	–	–	–	–	–	3	–	–	–	–	–
290	Ashfield	872	–	–	–	–	–	–	–	–	–	–	2	–
291	Halifax	867	–	–	–	–	–	–	1	–	–	–	–	–
292	Brewster	827	–	–	–	–	–	–	2	–	–	–	–	–
293	Royalston	795	–	–	–	–	–	–	–	–	–	–	1	–
294	Paxton	791	–	–	–	–	–	–	–	–	–	–	–	–
295	Charlemont	789	–	–	–	–	–	–	–	–	1	–	3	–
296	Boxford	778	–	–	–	–	–	–	5	–	–	–	1	–
297	Bolton	775	–	–	14	–	–	–	–	–	–	–	–	–
298	Carlisle	747	–	–	–	–	–	–	–	–	–	–	1	–
299	Princeton	713	–	–	–	–	–	–	–	–	–	–	–	–
300	Becket	689	–	–	9	–	–	–	–	–	–	–	–	–
301	Leverett	688	–	–	–	–	1	–	–	–	–	–	–	–
302	Granville	668	–	–	–	–	–	–	–	–	–	–	–	–
303	Richmond	624	–	–	–	–	–	–	–	–	–	–	3	–
304	Cummington	608	–	–	–	–	–	–	1	–	–	–	–	–
305	Truro	585	–	–	–	–	–	–	–	–	–	–	–	–
306	Eastham	582	–	–	–	–	–	–	–	–	–	–	–	–
307	Pelham	568	–	–	–	–	–	–	1	–	–	–	–	–
308	Plympton	532	–	–	1	–	–	–	1	–	–	–	–	–
309	Phillipston	481	–	–	–	–	–	–	1	–	–	–	–	–
310	Blandford	479	–	–	3	–	–	–	–	–	–	–	–	–
311	Worthington	471	–	–	1	–	–	–	–	–	–	–	–	–
312	Egremont	463	–	–	6	–	–	–	–	–	–	–	–	–
313	Dunstable	447	–	–	–	–	–	–	3	–	–	–	–	–
314	Warwick	444	–	–	–	–	–	–	–	–	–	–	–	–
315	New Braintree	439	–	–	–	–	–	–	–	–	–	–	–	–
316	Mashpee	434	–	–	–	–	–	–	–	–	–	–	–	–
317	Oakham	423	–	–	–	–	–	–	–	–	–	–	–	–
318	Chesterfield	422	–	–	–	–	–	–	1	–	–	–	1	–
319	Florida	421	–	–	–	–	–	–	–	–	–	–	–	–
320	Sandisfield	421	–	–	–	–	–	–	–	–	–	–	–	–
321	Westhampton	403	1	–	–	–	–	–	–	–	–	–	1	–
322	Wendell	391	–	–	–	–	–	–	–	–	–	–	–	–
323	Boxborough	376	–	–	–	–	–	–	–	–	–	–	–	–
324	Wales	367	–	–	–	–	–	–	–	–	–	–	–	–
325	Otis	364	–	–	–	–	–	–	3	–	–	–	–	–
326	Heath	359	–	–	–	–	–	–	–	–	–	–	–	–
327	New Salem	357	–	–	–	–	–	–	–	–	–	–	–	–
328	Hancock	332	–	–	–	–	–	–	–	–	–	–	–	–
329	Monterey	320	1	–	1	–	–	–	–	–	–	–	–	–
330	Windsor	314	–	–	–	–	–	–	–	–	–	–	–	–
331	Savoy	300	–	–	–	–	–	–	–	–	–	–	–	–
332	Washington	267	–	–	–	–	–	–	–	–	–	–	–	–
333	Plainfield	264	–	–	–	–	–	–	–	–	–	–	–	–
334	West Tisbury	260	–	–	–	–	–	–	–	–	–	–	–	–
335	Leyden	260	–	–	–	–	–	–	–	–	–	–	–	–
336	Hawley	257	–	–	–	–	–	–	–	–	–	–	1	–
337	Holland	247	–	–	–	–	–	–	–	–	–	–	–	–
338	Goshen	237	–	–	–	–	–	–	–	–	–	–	–	–
339	Rowe	233	–	–	–	–	–	–	–	–	–	–	–	–
340	Chilmark	226	–	–	–	–	–	–	–	–	–	–	–	–
341	Tyringham	213	–	–	–	–	–	–	1	–	–	–	–	–
342	Monroe	207	–	–	15	–	–	–	–	–	–	–	–	–
343	Alford	201	–	–	–	–	–	–	–	–	–	–	–	–
344	Middlefield	201	–	–	–	–	–	–	–	–	–	–	1	–
345	Shutesbury	191	–	–	12	–	–	–	–	–	–	–	–	–
346	Montgomery	178	–	–	–	–	–	–	–	–	–	–	–	–
347	Peru	142	–	–	–	–	–	–	–	–	–	–	–	–
348	Gosnold	136	–	–	–	–	–	–	–	–	–	–	–	–
349	Tolland	129	–	–	–	–	–	–	–	–	–	–	–	–
350	Gay Head	127	–	–	–	–	–	–	–	–	–	–	–	–
351	New Ashford	87	–	–	–	–	–	–	–	–	–	–	–	–
352	Mt. Washington	57	–	–	–	–	–	–	–	–	–	–	–	–
353	Tewksbury State Infirmary		–	–	–	–	–	–	–	–	–	–	–	–
354	Camp Edwards		–	–	–	–	–	–	–	–	–	–	7	–
355	Fort Devens		–	–	–	–	–	–	–	–	–	–	7	–
356	Westover Field		–	–	–	–	–	–	–	–	–	–	1	–

Dangerous to the Public Health, 1940—Concluded

Lobar Pneumonia		Measles		Menin. Meningitis		Mumps		Ophthalmia Neonatorum		Scarlet Fever		Syphilis		Tuberculosis, Pulmonary		Tuberculosis, Other Forms		Typhoid Fever		Whooping Cough		
Cases	Deaths	Cases	Deaths	Cases	Deaths	Cases	Deaths	Cases	Deaths	Cases	Deaths	Cases	Deaths	Cases	Deaths	Cases	Deaths	Cases	Deaths	Cases	Deaths	Line No.
15	*5*	*40*	-	-	-	*30*	-	-	-	*18*	-	*25*	*2*	*12*	*1*	-	*1*	-	-	*32*	-	
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	282
1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	283
-	-	-	-	-	-	-	-	-	-	1	-	2	-	-	-	-	-	-	-	-	-	284
2	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	285
2	-	4	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	286
-	-	1	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	287
-	-	1	-	-	-	-	-	-	-	-	-	1	-	1	-	-	-	-	-	-	-	288
-	-	1	-	-	-	1	-	-	-	-	-	-	-	3	-	-	1	-	-	-	-	289
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	290
-	-	-	-	-	-	-	-	-	-	-	-	1	-	2	-	-	-	-	-	-	-	291
-	1	1	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	292
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	293
-	-	-	-	-	-	-	-	-	-	-	-	1	-	1	-	-	-	-	-	-	-	294
-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	295
2	1	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	296
-	-	-	-	-	-	3	-	-	-	-	-	2	-	-	-	-	-	-	-	15	-	297
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	298
-	-	4	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	299
-	-	-	-	-	-	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	300
1	1	-	-	-	-	-	-	-	-	10	-	-	-	-	-	-	-	-	-	-	-	301
-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	302
1	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	303
-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	304
-	-	5	-	-	-	1	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	305
-	-	1	-	-	-	-	-	-	-	-	-	1	-	1	-	-	-	-	-	-	-	306
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5	-	307
-	-	-	-	-	-	-	-	-	-	2	-	1	-	-	-	-	-	-	-	-	-	308
-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	309
-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	310
-	-	-	-	-	-	11	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	311
-	-	2	-	-	-	-	-	-	-	-	-	2	-	-	-	-	-	-	-	7	-	312
-	-	3	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	313
1	-	-	-	-	-	-	-	-	-	-	-	2	-	-	-	-	-	-	-	-	-	314
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	315
-	-	-	-	-	-	-	-	-	-	-	-	6	-	-	-	-	-	-	-	-	-	316
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	317
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	318
-	-	-	-	-	-	4	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	319
1	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	2	-	320
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	321
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	322
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	323
-	-	11	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	324
1	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	325
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	326
-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	327
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	328
-	-	-	-	-	-	3	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	329
1	-	-	-	-	-	-	-	-	-	-	-	-	1	2	-	-	-	-	-	-	-	330
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	331
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	332
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	333
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	334
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	335
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	336
-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	1	-	-	-	-	-	-	337
1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	338
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	339
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	340
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	341
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	342
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	343
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	344
-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	345
1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	346
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	347
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	348
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	349
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	350
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	351
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	352
29	-	1	-	1	-	-	-	10	-	-	-	-	-	58	-	-	-	-	-	-	-	353
-	-	-	-	-	-	-	-	-	-	-	-	5	-	-	-	-	-	-	-	-	-	354
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	355
-	-	-	-	-	-	-	-	-	-	-	-	4	-	-	-	-	-	-	-	-	-	356

In addition to the above, there occurred 4 cases of **actinomycosis** with 4 deaths:

	Cases	Deaths
Brockton	1	1
Lawrence	1	1
Malden	–	1
Revere	–	1
Swampscott	1	–
Waltham	1	–

8 cases of **anthrax:**

Haverhill	1	–
Lowell	1	–
Lynn	4	–
Peabody	2	–

4 cases of **amebic dysentery** with 1 death:

Bridgewater	1	–
Brockton	1	–
Northampton	1	1
Worcester	1	–

327 cases of **bacillary dysentery** with 4 deaths:

Amherst	2	–
Arlington	3	–
Attleboro	4	–
Belchertown	31	–
Belmont	1	–
Beverly	4	–
Boston	21	2
Brookline	2	–
Burlington	5	–
Cambridge	23	–
Chelsea	1	–
Chicopee	1	–
Danvers	9	–
Dedham	1	–
Deerfield	1	–
Everett	1	–
Greenfield	3	–
Lawrence	2	–
Lowell	29	–
Lynn	6	–
Malden	1	1
Marblehead	1	–
Medfield	10	–
Medford	8	–
Merrimac	1	–
Milton	1	–
Natick	1	–
Northampton	2	–
Norwood	1	–
Pittsfield	8	–
Quincy	2	–
Randolph	1	–
Reading	2	–
Revere	1	–
Salem	13	–
Somerville	2	–
Sterling	4	–
Swampscott	1	1
Taunton	1	–
Templeton	87	–
Tewksbury	2	–
Tewksbury State Infirmary	1	–
Wareham	2	–
Watertown	1	–
Wenham	1	–
West Boylston	1	–
Westfield	5	–
Woburn	1	–
Worcester	12	–
Wrentham	3	–

13 cases of **infectious encephalitis** with 10 deaths:

Beverly	1	–
Boston	–	1
Brockton	1	–
Danvers	1	–
Gloucester	–	1
Greenfield	1	–
Holliston	–	1
Holyoke	1	1
Lowell	–	1
Lynn	–	1
Medford	1	1
Melrose	1	–
Merrimac	1	–
Palmer	1	–
Salem	1	–

	Cases	Deaths
Springfield	2	1
Taunton	–	2
Webster	1	–

1 case of **leprosy:**

Medford	1	–

7 cases of **malaria:**

Boston	1	–
Cambridge	5	–
Watertown	1	–

105 cases of **paratyphoid B fever** with 1 death:

Arlington	2	–
Bernardston	1	–
Beverly	2	–
Boston	14	–
Brookline	2	–
Cambridge	4	–
Chicopee	1	–
Concord	1	–
Danvers	1	–
Dartmouth	1	–
Dedham	1	–
Fall River	3	–
Haverhill	4	–
Holyoke	1	–
Lawrence	1	–
Lowell	2	–
Lynn	3	–
Marblehead	2	–
Marion	1	–
Medford	2	–
Milton	2	–
Newburyport	1	–
Newton	3	–
Peabody	1	–
Pittsfield	4	–
Quincy	1	–
Revere	2	–
Salem	2	–
Somerville	1	–
Springfield	1	–
Tewksbury State Infirmary	29	1
Wakefield	1	–
Waltham	1	–
Wareham	2	–
Wellesley	1	–
West Boylston	1	–
Worcester	3	–

13 cases of **pellagra** with 3 deaths:

Belmont	1	1
Boston	10	1
Gardner	–	1
Greenfield	1	–
Winchester	1	–

11 cases of **Pfeiffer bacillus meningitis** with 21 deaths:

Attleboro	1	1
Barnstable	–	1
Boston	–	3
Cambridge	–	2
Charlton	1	–
Dracut	1	–
Everett	–	1
Fairhaven	–	1
Falmouth	–	1
Framingham	1	–
Gloucester	–	1
Hanson	1	1
Millis	1	1
Nantucket	–	1
New Bedford	2	2
Northampton	1	–
Orange	1	–
Reading	–	1
Seekonk	–	1
Spencer	1	–
Waltham	–	2
Winchester	–	1

214 cases of **septic sore throat** with 30 deaths:

Acushnet	–	1
Amesbury	1	–
Andover	1	–
Arlington	1	–
Belmont	4	–
Beverly	3	–

	Cases	Deaths
Boston	61	2
Boxford	3	–
Braintree	–	1
Brockton	1	–
Cambridge	27	1
Chicopee	1	–
Danvers	7	–
Everett	–	1
Fall River	8	1
Fitchburg	1	–
Foxborough	1	2
Franklin	–	1
Gardner	1	–
Georgetown	1	–
Grafton	–	1
Greenfield	4	1
Haverhill	2	–
Ipswich	1	–
Lawrence	1	1
Leominster	1	–
Lexington	2	–
Lowell	–	1
Lynn	6	–
Malden	7	–
Medford	9	–
Melrose	2	–
Merrimac	3	1
Milford	2	–
Milton	1	–
Monson	–	1
Montague	1	1
Natick	–	1
Needham	–	1
New Bedford	5	2
North Adams	–	1
Northfield	1	–
Oxford	2	–
Peabody	1	–
Plymouth	1	–
Quincy	4	–
Revere	1	1
Salem	–	1
Salisbury	1	–
Saugus	1	–
Somerville	4	–
Sturbridge	5	–
Taunton	2	–
Topsfield	–	1
Wakefield	1	–
Waltham	2	1
Warren	1	–
Watertown	2	–
Webster	1	–
Westborough	1	–
Weston	1	–
West Springfield	1	–
Weymouth	1	1
Whitman	1	–
Wilbraham	–	1
Winchester	3	1
Wrentham	7	–
Worcester	–	1

17 cases of **tetanus** with 10 deaths:

Boston	1	1
Bourne	1	–
Burlington	1	–
Chelsea	1	1
Cohasset	1	1
Dracut	–	1
Fall River	2	1
Framingham	1	–
Revere	1	–
Saugus	1	1
Shrewsbury	–	1
Somerville	2	1
Wareham	1	–
West Stockbridge	1	1
Worcester	3	1

14 cases of **trachoma**:

Boston	6	–
Bridgewater	1	–
Everett	1	–
New Bedford	2	–
Plymouth	1	–
Randolph	1	–
Wakefield	1	–
Watertown	1	–

46 cases of **trichinosis** with 2 deaths:

	Cases	Deaths
Attleboro	1	–
Belmont	1	–
Boston	7	–
Cambridge	1	–
Fall River	1	–
Framingham	1	–
Franklin	1	–
Greenfield	2	–
Hadley	1	–
Haverhill	1	–
Lynn	4	–
Melrose	1	–
Monroe	–	1
Montague	3	–
Newton	1	–
North Andover	2	–
Quincy	3	–
Webster	1	–
Wellesley	5	–
Winchester	8	–
Worcester	1	1

181 cases of **tuberculosis, hilum**:

Acton	1	–
Billerica	1	–
Boston	150	–
Brockton	1	–
Cambridge	1	–
Chicopee	1	–
Everett	2	–
Fitchburg	1	–
Haverhill	3	–
Holyoke	1	–
Lynn	4	–
Malden	1	–
Marblehead	1	–
Medford	1	–
Monson	1	–
New Bedford	5	–
Northampton	1	–
Plainville	1	–
Quincy	1	–
Salem	2	–
Waltham	1	–

52 cases of **undulant fever** with 1 death:

Acton	1	–
Adams	1	–
Amherst	1	–
Ashburnham	1	–
Auburn	1	–
Barre	1	–
Boston	1	–
Brookfield	1	–
Chelmsford	1	–
Chelsea	1	–
Danvers	1	–
Dartmouth	1	–
Dedham	1	–
Deerfield	1	–
Freetown	1	–
Greenfield	1	–
Haverhill	1	–
Hopedale	1	–
Lynnfield	2	–
Middleborough	1	–
Millbury	1	–
Milton	1	–
Natick	1	–
North Adams	2	–
Northbridge	1	–
Petersham	1	–
Pittsfield	1	–
Plymouth	2	–
Provincetown	1	–
Sherborn	1	–
Shrewsbury	2	–
Southbridge	2	–
Springfield	2	–
Stockbridge	1	–
Swampscott	1	–
Taunton	1	–
Ware	–	1
Wayland	1	–
Webster	1	–
West Boylston	2	–
West Springfield	1	–
Whitman	1	–
Williamstown	1	–
Worcester	3	–

REPORT OF THE DIVISION OF FOOD AND DRUGS

Hermann C. Lythgoe, *Director*

The Food and Drug Division during the year 1940 has been engaged in the usual routine work relative to the enforcement of the laws pertaining to the sale of milk, foods and drugs; the slaughtering laws; the cold storage laws; the bakery laws; the frozen dessert laws; the laws pertaining to the pasteurization of milk; the laws pertaining to the bottling of carbonated nonalcoholic beverages; certain phases of the narcotic law; the law pertaining to the sale of wood alcohol; the laws pertaining to the sale of articles of bedding and upholstered furniture; and examination of liquors, chemicals, etc., for police departments.

At the laboratory in Westfield there are now employed one assistant chemist in charge, one junior bacteriologist, two inspectors, one of whom is paid from United States funds, and one clerk, who is also paid from United States funds. This unit is giving Western Massachusetts more service than has ever been given by the department, and whereas the total cost to the State may be somewhat higher, the actual cost of collecting and examining each sample is considerably less and the actual cost of each sanitary inspection is materially reduced because of saving in travel and hotel bills.

Licenses and permits have been issued as follows:

Under the law pertaining to the sterilization of feathers, down, and secondhand material, ten licenses at $50.

Under the frozen dessert law, 30 permits to out-of-State manufacturers, the fee depending upon the quantity imported, the total fees amounting to $845.

Under the law pertaining to State licenses for dealers in wood alcohol, 178 licenses at $10.

Under the narcotic law, 50 licenses at $10.

Under the law pertaining to the importation of carbonated nonalcoholic beverages, 45 permits at $20.

Under the law pertaining to permits for manufacturing carbonated nonalcoholic beverages, there was $2,610 received from the cities and towns of the State, representing half of the fees collected by them.

There were 58 licenses for the operation of cold storage warehouses at $10.

Under the law pertaining to the granting of permits to out-of-State manufacturers and wholesale dealers in articles of bedding and upholstered furniture, there were 66 permits issued at $50.

The total of the foregoing fees was $11,015.

Prosecutions

There were 276 prosecutions, of which 244 resulted in conviction. Nine cases were dismissed. Twenty-two were found not guilty, and one defendant located without the Commonwealth defaulted. Of the cases dismissed, five pertained to duplicate cases against one person or represented cases where a partner was convicted. In one instance the manufacturer was convicted and the retailer's case was dismissed. The prosecutions were thirty less than in 1939. A summary will be found in Table 1.

The prosecutions under the milk law were less than usual. One case pertained to low standard milk, one to the removal of cream, seven to the addition of water, sixteen to the sale as pasteurized of milk that was not pasteurized, seven for violation of the milk grades (mostly for high bacteria counts), and eight for violation of the pasteurization regulations.

There were eleven convictions pertaining to the adulteration and misbranding of butter. These cases were brought against a partnership, each partner paying a fine in one case, and the balance of the cases being placed on file.

There were five cases for the sale of clams containing added water, of which two resulted in a finding of not guilty.

There were three convictions for the sale of cream cheese not conforming to the standard specified by law.

There were fourteen cases pertaining to the adulteration and misbranding of olive oil, of which thirteen resulted in conviction. One person was found not guilty in the Chelsea court. The evidence pointed overwhelmingly toward a conviction and was not disputed.

There were six convictions for violation of the vinegar law, all pertaining to the same corporation.

The meat cases constituted the largest number. There were eleven convictions for violations of the law pertaining to the use of sodium sulphite as a preservative. There were one hundred cases pertaining to the sale of decomposed meat, of which eighty-seven resulted in conviction. There were twelve cases pertaining to the use of an excessive quantity of soybean flour in sausages. One case was dismissed on motion of the Commonwealth, the corporation paying a fine on another case.

There were twenty-five cases pertaining to unsanitary conditions in food factories, of which twenty-three resulted in conviction. Of these cases five pertained to unsanitary markets and restaurants, thirteen to bakeries, two to frozen dessert factories, and five to soft drink factories.

There were nine cases pertaining to the sale of adulterated drugs, of which eight resulted in conviction.

There were two cases for violation of the slaughtering laws, both resulting in conviction.

There were thirty-five cases pertaining to violation of the laws relating to bedding and upholstered furniture. This is ten more than were prosecuted last year. They resulted in thirty convictions and pertained to the use of secondhand material, improper labeling as to the character of material used for filling, improper labeling as to the presence of down in feather pillows, and the use of secondhand metal in the manufacture of bed springs.

There were two convictions for obstruction of inspectors, one pertaining to an inspector of this Department and one pertaining to a local slaughtering inspector.

Milk

There were 5,357 samples of milk examined chemically, representing samples of milk collected in Eastern Massachusetts and examined in Boston, samples collected in Western Massachusetts and examined in Westfield, and also 385 samples collected in the Southern Berkshire District by the departmental sanitary food inspector assigned to that district. Of these samples fifty-one showed removal of a portion of the cream, and forty-five showed addition of water. The watered samples are somewhat in excess of what were obtained in prior years but represent only 0.84 per cent of the samples collected. This does not represent the relation of added water to the entire milk supply of the State. Usually two or three collections must be made before the person actually responsible for the watering is apprehended, and quite frequently from 10 to 20 samples of watered milk are obtained from the person who is prosecuted.

Table 2 shows the variation in the milk solids of the samples collected. Table 3 shows the average composition of the milk samples collected and examined. A study of these figures shows a relatively high composition of the milk sold to the consumer. The average solids was 12.88 per cent and the average fat was 4.04 per cent, including in the average the above-mentioned samples of adulterated milk. When one considers that our standard is 12 per cent solids and 3.35 per cent fat, it is very evident that the people of this State enjoy a very rich article of food in the ordinary market milk. These figures, however, include the Grade A milk. Excluding the milk samples collected in the Southern Berkshire District, the average composition of the 4,972 samples of milk was 12.82 per cent solids, 4.01 per cent fat. Excluding from these figures the analyses of the 258 samples of Grade A milk, the average solids then became 12.79 per cent and the average fat 3.99 per cent. The average composition of the 258 samples of Grade A milk was 13.50 per cent total solids and 4.42 per cent fat, which is considerably above the Grade A standard.

There is a variation in the composition of the milk sold in different parts of the State. Most of the milk in Eastern Massachusetts represents mixtures of milk from many herds, much of which is produced by the Holstein breed of cattle; whereas in Western Massachusetts there are more dealers selling smaller quantities of milk, and there is a greater demand for the milk produced by the Guernsey and Jersey breeds. This is still more marked in the Southern Berkshire District. For example, milk with 12 per cent solids represented 62 per cent of the samples collected in Eastern Massachusetts, 48 per cent collected in Western Massachusetts, and 22 per cent collected in the Southern Berkshire District. Milk with 13 per cent solids represented 24 per cent of the samples collected in Eastern Massachusetts, 36 per cent collected in Western Massachusetts, and 48 per cent collected in the Southern Berkshire District. The variation in total solids of milk collected in different parts of the State, including the composition of the Grade A and of the certified milk, will be found in Table 4.

Certified Milk

Certified milk sold in Massachusetts is produced upon nine farms, six of which are located in Massachusetts and three just beyond the State's border in New Hampshire, Vermont, and New York. These dairy farms have been inspected several times by one of the veterinary inspectors of the department; and while at all times things have not been entirely satisfactory, conditions on the whole have been reasonably satisfactory. One Medical Milk Commission found it necessary to suspend a certificate, which was subsequently reissued after the objectionable features had been removed. One of the veterinary inspectors of the Department reports as follows as a result of his inspections of these dairies:

> Massachusetts certified dairies are located in Beverly, Needham, Auburn, Spencer, Whately and Dartmouth.
>
> One New Hampshire dairy located at Wilton disposes of practically its entire output in this State, while a Bennington, Vermont certified plant sells a small amount in Pittsfield and North Adams.
>
> All dairies have been inspected during the past year, the Massachusetts plants receiving seasonal visits in order to determine the methods used in handling this product. About two-thirds of the larger dairies' supply is pasteurized, two dairies sell their product raw, while other dairies sell only a portion of the output pasteurized.
>
> All dairies are operating under the rules and regulations laid down by the American Association of Medical Milk Commissions and the regulations adopted by the Massachusetts Department of Public Health. In some instances foremen and herdsmen are not familiar with the many requirements of the American Association but rely on their judgment which is based solely on the handling of an average dairy. A distribution of printed association and state requirements among employees would tend to familiarize the personnel with the care to be exercised in handling this milk.
>
> Tuberculosis-free herds are to be found at all dairies, all being listed as United States (B. A. I.) accredited. To safeguard against an outbreak going undetected, regular tests of all bovines are made at intervals of twice each year by government veterinarians.
>
> To keep free from brucellus abortus or Bang's disease is now among the major problems of all cattle owners and particularly the certified producers who dispose of any raw milk.
>
> Regular blood tests to determine any such trouble are made and all cows considered affected, or likely to be, so-called suspicious ones, are removed from the herd. Owners have found it to their best economic interests to check closely against this disease as well as against mastitis which has long been the cattle owner's foe. In their vigilance the public gains protection and as the cattle owner of today realizes the loss in revenue from affected udders, a closer scrutiny may be expected.
>
> At the certified plants with few exceptions, group samples are taken from each herd weekly or more often as a check against streptococcus, staphylococcus and other dangerous micro-organisms. It cannot be too strongly emphasized that the utmost vigilance be at all times maintained to keep free of all milking herds any diseased animals.
>
> In interpreting "diseased cattle" only the normal animal known by tests to be free of constitutional ailments and also to be free from any local lesions that the experienced eye and trained examiner are able to detect should be designated as in health. If the safety factor of this product is to be maintained, and the American Association members guarantee that the milk "is the highest grade of milk obtainable" a stricter watch on the health of the pro-

ducing bovine seems to be one of the answers. Enlarged knees and hocks and other tumefactions about the body which give evidence of pain or pressure, evidence of actinomycosis, sore legs and feet which affect the animal's gait, abnormal uterine discharges and "slight" suppurations from affected portions, should be given only the strictest ruling by those in charge and that to the effect of removal at once from the milking line. Replacing animals in the line after parturition should be done only after the milk has been found normal by laboratory analysis.

All dairy rooms have been found sanitary, although at one plant modern improvements will soon be necessary. Those in charge of these dairies aim for low bacteria counts and are now fully aware of most conditions which cause high counts. As the greater responsibility rests upon the certified dairy employee over the ordinary dairy milker or worker, a changing personnel may tend toward higher counts.

During the past year one certified goat dairy was inspected at Castleton-on-Hudson, New York. Here, 130 goats were found all in good condition; a finely-equipped stable and dairy room were seen.

It is indeed fortunate that such a large quantity of the certified milk is voluntarily pasteurized.

Phosphatase Test

The phosphatase test has been used with the same satisfactory results as during the past four or five years. Occasionally, but rarely, a positive phosphatase test in pasteurized milk was the fault of the construction of the apparatus together with the ignorance of the operator, but most of the instances were deliberate violations on the part of the person doing the work.

Many towns have adopted regulations permitting the sale of only pasteurized milk or of certified raw milk. This has forced persons who do not believe in or approve of pasteurization to install pasteurizers in order to sell their product, and such persons see no moral violation of the law in selling raw milk with a "pasteurized" cap on the bottle. This violation, however, is being somewhat reduced. In 1938 there were 56 cases; in 1939 there were 29 cases; and in 1940 there were 24 cases for violations of this law.

Bacteriological Examination of Milk

There were 7,810 samples of milk examined bacteriologically, but these figures do not include the examinations made during the studies on high temperature, short time pasteurization of milk. A summary of these analyses is given in Table 5, the samples being segregated as per the point of collection or examination. The samples examined in Boston represent milk collected in the eastern part of the State, including Worcester. The samples examined in Westfield were collected in the western part of the State at points beyond Worcester but do not include the samples collected in the Southern Berkshire district, which samples, however, were examined in Westfield.

The certified milk examined in Westfield was obtained from three dairy farms, and that examined in Boston represented milk produced from the other certified dairies except one dairy supplying the City of Worcester and the goat milk dairy in New York State. It will be noticed that the geometric mean of both the raw certified and pasteurized certified milk is higher in the western part of the State. One of these dairies lost its certification, but this was subsequently reissued by the Commission after the necessary corrections were made. The balance of the samples of milk examined in Boston represent a uniform collection from the various dealers, but the samples examined in Westfield represent excessive collections from dealers furnishing milk with high counts, the purpose being to affect, if possible, the elimination or cleaning up of the dairy farms responsible for the high-count milk furnished to the pasteurizing establishments. More milk dealers in the eastern part of the State have laboratory control of the product they are buying and selling than do the dealers in western Massachusetts, and this has some bearing upon a relatively lower count of the milk sold in eastern Massachusetts.

On the whole, the average bacterial quality of the milk was good. The standard for Grade A pasteurized milk is not exceeding 10,000, and for pasteurized milk not exceeding 40,000. The average count of each of these grades was less than half of the standard.

The raw milk going to pasteurization plants compares very favorably with the raw milk sold as such. In one instance that going to the plants was slightly less, and in another instance was slightly greater than the milk sold raw. This is another refutation of the often erroneously mentioned remark that milk which is too poor to be sold raw is pasteurized.

The milk collected in the Southern Berkshire district is largely raw milk, there being but few pasteurization plants in that part of the State. In this instance, however, it is interesting to note that the average count of the raw milk going to pasteurization plants was less than half the count of the raw milk sold as such.

Inspection of Pasteurization Plants

There are slightly more than 800 such plants in the State. There were 838 inspected, the total number of inspections being 1,460. The defects were not so numerous as in the past, general unsanitary conditions representing only 0.9% of the total inspections. There were 121 irregularities pertaining to recording thermometer charts; 115 irregularities pertaining to unsanitary condition of pipe lines, couplings, and valves; 64 instances of dirty pumps; 42 instances of failure to use filter or using filter which was dirty; 38 instances of irregularities pertaining to caps and bottle equipment; 33 instances pertaining to dirty coolers; and 15 violations pertaining to the absence or improper use of thermometers.

As usual, not all of the plants were inspected. A few plants operate only two or three days a week, some operate only at night time, and others operate at varying times during the day; consequently, such plants are liable to be missed in the ordinary routine inspectional work.

High Temperature, Short Time Pasteurization

There has been a request made to the department to again legalize high temperature, short time pasteurization. In order that we might obtain first hand information relative to this process, arrangements were made to perform efficiency tests on some of these plants located in neighboring States. The recent invention of the flow diversion valve has materially improved this process.

To investigate the safety and efficiency of modern, high temperature, short time pasteurizing, inspections were made and samples taken for bacteria counts at several plants in Connecticut and New York States. These include the Bryant & Chapman plant and the R. G. Miller Co. plant in Hartford (both General Ice Cream Corporation plants), the Maplehurst Dairy, Stamford, the Konyk Dairy, Cohoes, N. Y., the Borden Company, Albany, N. Y., and the Pine Grove Dairy, Schenectady, N. Y. The proprietors or managers of these establishments have been very cooperative in permitting experimental samples to be taken, and in answering questions and demonstrating their apparatus. Mr. E. G. Woodward, Director of the Connecticut Dairy and Food Commission, Dr. T. W. Workman, and Mr. Green of the same department, and Dr. John Miller of the New York State Health Department were very helpful in making arrangements for inspection, and all were entirely frank in discussing the present status of this form of pasteurizing.

For "high-short" pasteurizing, there are in common use two general types of apparatus, differing in the means of heating the milk to the required 160° temperature. The Electro-Pure unit produces the final heat by passing milk between two carbon electrodes. The other type uses steam as the heating medium. Both types may or may not use regenerative heating and cooling.

Efficiency

The Connecticut authorities informed us that "high-short" units had been permitted only in plants which had exceptionally clean, carefully supervised sources of supply. In addition, none of the places inspected used a heating unit for more than two and a half hours' run. It is suggested that using even a small quantity of milk with thermophyls would be likely to cause a contamination and subsequent build-up in the apparatus. However, this is just as true of vat type pasteurizing under similar conditions. The percentage of bacteria destroyed by pasteurization as determined by standard plate method in samples of milk taken at start and finish of the day's work in the several plants follow:

	% Bacteria Reduction at Start of Day's Operation	% Bacteria Reduction at End of Day's Operation
Plant A	83%	84%
Plant B	86%	85%
Plant C	95%	98%
Plant D	95%	97%
Plant E	97%	96%
Plant F	95%	97%

In all instances but one, samples of pasteurized milk showed a bacteria count within the limits established in Massachusetts. In that instance, the raw supply was of very high count, so that even a 95% reduction in pasteurizing left from 38,000 to 105,000 bacteria per cubic centimeter by the standard plate method.

Composition of Goat Milk of Known Purity

Studies upon the chemical composition of goat milk were continued to ascertain if possible the reason for the great difference between the serum refraction of the milk produced in the winter and in the summer. The bacterial counts were made because persons from whose goats these samples were obtained requested that bacterial counts be made and the results included in the reports received from the department. All the samples examined represented afternoon or evening milking performed in the usual way at the dairy.

The samples for bacterial counts were transferred to a sterile test tube by means of a sterile pipette. The tube was closed with a sterile rubber stopper, was cooled in ice water, and was placed in a carrying case refrigerated by ice. The samples were examined the next day by the standard plate method of the American Public Health Association. The samples for chemical examination were collected either in four or eight ounce bottles from the mixed milking of each goat and from the herd milk. These samples were cooled and were delivered to the laboratory the next morning.

Results of Bacteriological Investigation

The bacterial counts were, on the whole, very low. There are two reasons for this: first, the goat milk business is a hobby with the goat breeders who exercise scrupulous care in the milking and subsequent handling of the product; second, the goat udder apparently secretes fewer bacteria than does that of the cow. Dr. A. K. Besley of the United States Bureau of Animal Industry states [1] that he collected samples aseptically from twenty-three goat udders, and 40 percent of them did not show any bacteria. Table A gives a summary of the counts of one hundred thirty-four samples collected during February, March, and April, 1940, of seventy-two samples collected in May and June, 1940, and of the combined figures. For comparative purposes there is also given the results of the examinations of one hundred and three samples of certified milk collected between December, 1938, and May, 1940, from wagons delivering this material to the consumers.

Table A.—*Bacterial Counts*

	Goat Milk 1940			Certified Milk
Collected	Feb. March April	May and June	Feb. to June	
Lowest count	Less than 10	20	Less than 10	300
Lower quartile	135	300	139	1,600
Median	730	1,666	859	2,150
Geometric mean	586	1,349	815	2,131
Upper quartile	1,300	5,000	2,828	3,000
Highest count	65,000	85,000	85,000	7,100
Number of samples	134	72	206	103

[1] "Recent Investigations of Goat's Milk," A. K. Besley, *American Journal of Public Health* 30: 185, 1940.

The bacterial counts of the certified milk samples are less variable than those from the goat milk samples, but this is not surprising when one considers the "frills" associated with the dairy barn, the cow, the milker, etc., on certified milk farms. The arithmetic average of the bacterial counts from the certified milk very closely approximates the geometric mean, being 2,416 and 2,131, respectively, thus showing almost complete absence of unusually high or low count samples. The geometric mean of the counts of the samples of goat milk was only 815, but the arithmetic mean was higher, namely, 4,152. Twenty-five per cent of the certified milk samples had counts above 3,000, but only 17.5% of the goat milk samples had higher counts, yet 10% of the goat milk samples had higher and 26.2% had lower counts than did any of the certified samples.

An unconfirmed rumor that mastitis was to some extent prevalent in some goat herds led to the collection from individual goats of about one hundred samples to be examined with reference to that condition by the method of the American Public Health Association. The veterinary inspector of the Massachusetts Department of Public Health who collected the samples, gave a careful physical examination of the udders of each goat and was unable to find any evidence of mastitis. The bacteriological examination gave no evidence of the presence of mastitis. Except for the examination for mastitis, no attempt was made to identify any of the bacterial flora.

Variation in Milk Serum Concentration

There is considerable seasonal variation in the refractive index of the copper serum of goat milk. Many years' experience with this method shows no great variance between the summer and winter figures from samples of cow's milk. A compilation of results from two hundred and thirty-three samples of cow's milk of known purity collected in the winter months with three hundred and eighty-five samples collected in the summer months gave 37.8 and 37.6 respectively as the averages for this figure. Many of the samples included in this compilation were those collected by inspectors of the Massachusetts State Board of Health and were used in the development of the copper serum method.[1]

It is well recognized that goat milk has a higher "albumin" content than does cow's milk. (By the term "albumin" used herein is meant non-casein proteins.) The "albumin" figures for goat milk available prior to this work were obtained from samples collected in the winter months. It was assumed that possibly this component may be higher in the winter and thus furnish an explanation for the seasonal variation in the serum concentration. The casein was determined upon fifty-four samples of goat milk collected in February, 1939, and upon ninety-four samples collected from April 30 to June 26, 1940. The results of these analyses are given in Table B.

Table B.—*Percent of Casein in the Proteins of Goat Milk*

	54 Samples Collected February, 1939	94 Samples Collected April to June, 1940
Lowest	65.0	66.4
Lower quartile	71.8	72.9
Median	74.3	75.8
Average	74.5	76.0
Upper quartile	76.6	78.8
Highest	83.4	90.8

The casein content of the proteins of goat milk is lower than that of cow's milk. L. L. Van Slyke[2] reports the following figures for the casein content of the proteins of the milk of United States Breeds of Dairy Cattle.

Table C.—*Casein in the Proteins of Cows' Milk* (*Van Slyke*)

Breed	Percent Casein
Holstein-Friesian	77.5
Ayrshire	80.1
American Holderness	79.2
Shorthorn	81.3
Devon	78.9
Guernsey	81.7
Jersey	82.3

[1] "Report on Dairy Products," Hermann C. Lythgoe, *U. S. D. A. Bureau of Chemistry Bulletin*, 132: 124, 1910.

[2] "Conditions Affecting the Proportions of Fat and Proteins in Cow's Milk," L. L. Van Slyke, *Journal of the American Chemical Society*, 30: 1166.

A perusal of these two tables shows a lower albumin content of cows' milk as compared with that of goat milk. The albumin content of a number of goat milk samples plotted against the copper serum refractive index indicated a definite although not very close relationship. These figures averaged are shown in Table D.

TABLE D.—*Comparison of Copper Serum Refraction with "Albumin"*

Copper Serum Refraction	Number of Samples February	Average Serum Refraction	Average "Albumin" %	Number of Samples April to June	Average Serum Refraction	Average "Albumin" %
35.8 to 36.9	4	36.6	0.91	18	36.6	0.66
37.0 to 37.9	15	37.4	1.05	41	37.5	0.74
38.0 to 38.9	10	38.5	1.06	24	38.4	0.78
39.0 to 39.9	12	39.4	1.08	7	39.4	0.85
40.0 to 40.9	9	40.3	1.11	3	40.4	1.02
41.0 to 42.9	3	41.7	1.16	–	–	–

The summer samples giving copper sera with an average refractive index of 38.4 had an albumin content of 0.78%, while the winter samples with substantially the same serum concentration of 38.5 had an albumin content of 1.06%. It was felt that sera of more uniform concentration could be obtained by applying a method used some years ago. The method is as follows: The serum, after reading its refractive index, is placed in a test tube connected with an air condenser; the test tube is placed in a boiling water bath for five minutes; it is then cooled, filtered, and the refractive index of the filtrate is again determined. The results of these figures obtained from eighty-one samples of milk collected in the winter and fifty-eight samples collected in the summer are shown in Table E.

TABLE E.—*Goat Milk Copper Refraction Before and After Heating*

February to April 2, 1940—81 Samples

	Before Heating	After Heating
Lowest	36.2	35.2
Lower quartile	38.4	36.5
Median	39.05	36.95
Average	39.09	37.04
Upper quartile	39.7	37.5
Highest	41.4	38.6

April 4 to June 30—58 Samples

	Before Heating	After Heating
Lowest	36.0	34.0
Lower quartile	37.1	35.9
Median	37.70	36.32
Average	37.67	36.37
Upper quartile	38.2	36.8
Highest	39.7	37.8

These figures show less variance between the extremes of the heated serum than of the unheated serum, but the average figure upon the summer samples, 36.37, was somewhat less than the winter average of 37.04. Another reason for this difference is needed. Dr. Fred F. Flanders, Chemist of the Massachusetts State Purchasing Agent, with whom these figures were discussed, suggested that the water content of the milk itself may be responsible for the difference. A high water content would produce a serum of low concentration, and a low water content would act otherwise. This suggestion was applied to these figures. The average water content of the winter samples was 85.46% and of the summer samples was 88.17%. The average lactose was 4.86%; albumin 0.36%; ash 0.83%; copper serum refraction 38.7 of the winter samples, and similar figures for the summer samples were: 4.39%, 0.23%, 0.78%, and 36.4. The serum solids of the milk itself averaged 6.05% during the winter months, and 5.40% during the summer months. Calculating these figures to the fat-casein free basis we obtain 6.61% and 5.77%, respectively, showing a greater difference between the values for the sera than for the milk itself.

Detection of Sodium Alginate in Dairy Products

By reason of finding cane sugar in a sample of cream submitted by a milk inspector of a city, together with subsequent conversation with the expert of the dairy company, it was believed that a commercial sodium alginate was responsible for the presence of cane sugar.

The following method has been devised.

Specific Test: The specific test for alginic acid is as follows: To 20 grams of milk, cheese, cream or ice cream, add a volume of concentrated HCl approximately equal to the water content of the sample taken. Shake thoroughly, add a little sand (acid washed and ignited), bring to a boil and boil 30 seconds with frequent shaking. Transfer to a 50 cc. centrifuge tube with the aid of 10–20 cc. of alcohol. Centrifuge 10 minutes, or until the solid matter forms a compact cake at the bottom of the tube, and decant as much of the supernatant liquid as possible from the solid matter, taking care not to lose any of the solids. The centrifuge should be warm enough to keep the fat liquid and should be allowed to slow down without braking so as to avoid stirring up the solids. In some cases, the fat mixed with part of the solids forms at the surface a dense cake which must be punctured with a stirring rod to allow removal of the liquid. The decantation is best carried out against a white background to facilitate observation of the solids through the dark solution.

Wash the solids repeatedly with 75% ethyl alcohol by shaking, centrifuging and decanting as above until the wash solution is neutral to litmus paper and is colorless. Then wash twice in the same manner with ether.

Evaporate the last traces of ether by warming the tube in a beaker of hot water and directing a current of air into it. Dissolve the residue so far as possible in 10 cc. of tenth normal NaOH by shaking a few seconds. Filter, wash the tube and paper with a few ccs. of water and to the filtrate add an equal volume of 95% ethyl alcohol. Centrifuge 10 minutes, decant and supernatant liquid and wash the solids with 75% alcohol by centrifuging and decantation until the wash solution is neutral to litmus paper. The solution should be centrifuged and decanted even when it appears clear as small amounts of gum are invisible beforehand. If the separated gum is now white and free from any yellow or brown color, pass over the next paragraph.

Suspend the gum in 10 cc. of distilled water and add tenth normal NaOH dropwise, with shaking, until the solution is just alkaline to litmus paper. Add 6 cc. saturated $Mg(NO_3)2$ solution and shake thoroughly. Centrifuge ten minutes and decant the supernatant liquid from any precipitate into another centrifuge tube. Discard the precipitate and make the solution acid with a drop of concentrated HCl. Centrifuge, decant and wash the precipitate with 75% alcohol as before until neutral.

Dry the gum by warming the tube with hot water and blowing air into it until no odor of alcohol is perceptible. Dissolve so far as possible by shaking with 0.15 cc. of tenth normal NaOH, add 1 cc. of sulphuric acid reagent[1], shake thoroughly and let stand at room temperature.

Within a few minutes to several hours, depending on the amount of alginic acid present, the solution will develop a pink color deepening through cherry red to magenta and finally becoming a deep purple. When the amount of gum is 0.5 mg. or less, the purple color is permanent for at least one week but with larger amounts, the color eventually changes to a brown-black.

The following table shows the time required for development of the color with various amounts of the gum:

[1] This reagent was prepared by precipitating $Fe(OH)_3$ from $FeCl_3$ solution with NH_4OH, washing the $Fe(OH)_3$ until neutral, drying on the steam bath and, finally, saturating concentrated H_2SO_4 with the dry Fe_2O_3 by allowing the two to stand in contact for several days. The clear acid solution was then decanted from any excess $Fe_2(SO_4)_3$.

Weight of Dry Gum in Milligrams	Time for Development of Violet Tinge	Time for Development of Deep Purple Color
0.04		No color developed
0.1	Overnight	Not reached after standing one week
0.3	Four hours	Overnight
0.5	Four hours	Overnight
1.0	Ten minutes	Three hours
3.3	Two minutes	One hour

Foods Other Than Milk

Table 6 shows a summary of the analyses of 1,874 samples of foods other than milk examined during the past year. The discussion of this table will be confined mostly to those articles which were found to be more or less adulterated.

The seven samples of butter reported adulterated include samples found to contain less than 80% of fat. The persons from whom these samples were collected were buying butter containing more than 80% fat; were incorporating water into it; and were selling the diluted butter labeled as having been manufactured in Vermont, whereas it was Western butter and the dilution was performed in Massachusetts. There were very few samples slightly below the legal standard.

The fourteen samples of cheese reported adulterated were all cream cheese not conforming to the Massachusetts standard for fat and moisture, or both. The four samples of cider contained sodium benzoate and were not so labeled. The fourteen samples of clams contained added water in excess of the quantity necessary for washing. The eight samples of cream were mislabeled as to the grade. The samples of fish, scallops and shrimp represented material in cold storage which was either suspected by the inspector of being unsatisfactory or upon which requests for extension of time had been made and the inspector deemed an analysis to be necessary prior to departmental action. The frozen desserts all conformed to the chemical standards required by the law. Three maple products sold as such were adulterated with cane sugar.

The largest number of adulterations in foods pertained to meat and meat products. Some of the hamburg and sausage samples were adulterated either by reason of the presence of sodium sulphite in excess of that permitted by law, or were sold without the label required by law. A number of the sausage samples were found to contain soy bean flour in excess of 2%.

The balance of the meat samples represented decomposed meat. In collecting these samples the inspectors exercised discrimination in making the purchases, there being no particular reason for spending money for inspectional purposes if the visual examination of the material indicated a liability that it would conform with the requirements of the law. If, however, meat or meat products are offered for sale below the market price, the inspector's suspicions are naturally aroused, and it is from this type of article that most of the samples are obtained. The fault in most instances is that of the retailer who shuts off the refrigeration Saturday night to save on the electricity bill and sells the leftovers on Monday. The retailer in making up the so-called "homemade" sausage meat will utilize meat trimmings which cannot otherwise be sold, storing them in the refrigerator until he has accumulated a sufficient quantity, then putting them through the meat grinder and adding the necessary salt and spices.

Our attention was called to probable violation of the law by the sale of mixed olive and cottonseed oil, labeled incorrectly as to the percentage of olive oil in the mixture. In investigating this complaint it was found that a much more serious situation existed in the sale as pure olive oil or pure imported olive oil of cottonseed oil artificially colored and flavored. These adulterated oils also contained in some instances corn oil; in others, mixtures of sesame oil and cottonseed oil with some olive oil; and in a few instances consisted of mixtures of corn oil and cottonseed oil with a very small quantity of rancid olive oil to give the material sufficient color and flavor to imitate olive oil.

It was found impossible to apprehend the person responsible for these conditions. Much of the sale of this material was made under pressure, the retail dealer declining to state from whom he purchased the article and also declining to state the character of the pressure urged upon him which would cause him to buy an article he realized to be adulterated.

In one instance the retailer identified a photograph obtained from the rogues' gallery and he identified the person in court, resulting in this instance in a fine of $200.00. The convicted person had purchased the article from somebody unknown to him and he assumed that the oil was pure olive oil. The judge who imposed the fine remarked that the man higher up would probably pay the fine.

Persons dealing in this type of oil are now changing their procedure and are selling from house to house and not to the stores. One person, who boasted that he would not get caught, finally was caught making sales to restaurants.

In one town, three persons were brought before the court for violation of this law, because of their failure to state where the oil was purchased. The judge continued the cases and ordered the defendants to inform the department where the oil was purchased. This was not done, and the judge again continued the cases. When the cases were called a third time, the defendants still were unable to state where they had purchased the oil. They were each fined $25.00, which they paid. After the cases were over, one of the defendants informed the inspector where he purchased the oil, stating that he would rather pay the $25.00 fine than get into any trouble with the vendor.

The adulterated samples of condimental sauces, pickles, relishes and soft drinks were so-called because of the presence of benzoic acid, which was not declared upon the label as required by law. A number of samples of vinegar were collected because of a complaint, but most of the samples were collected in order that an investigation could be made as to the lead content of this article. The adulterated samples were all traced to one corporation and included wine vinegar as well as cider vinegar.

Miscellaneous Bacteriological and Chemical Examinations

The results of these examinations will be found in Tables 7 and 8. The frozen desserts occasionally were in violation of the bacteriological standard, but on repeat collections, as provided by regulation, the high counts were found to have been reduced. Quite a few of the cream samples, however, were found to run exceptionally high, rather higher than is found in milk samples.

As the result of a crabmeat investigation, it was ascertained that many samples contained bacteria of the colon group, and smears taken from the fingers of the women who were opening the crabmeat also were found to contain bacteria of the colon group.

The miscellaneous samples pertain to caustic poisons, bleaches, silver polish and wash water employed in soft drink plants as well as samples of filling for articles of bedding.

Sanitary Inspections

There were 274 restaurants inspected in 11 cities and 23 towns. Second inspections were made in 14 restaurants. In many of these inspections the local inspectors or members of local boards of health were present at the request of this Department.

A comparison of the inspection reports show that restaurants on the whole are not nearly so well kept as are the bakeries. This is possibly due to the absence of law providing for specific rules and regulations governing restaurants. In only a few cities and towns are there any local regulations of this character, and in some instances they are not rigidly enforced.

The use of tobacco appears to be quite common in a great many restaurants. During rush hours glasses are sometimes reused without being washed. There were a number of hearings given and in a few instances on subsequent inspection there were prosecutions.

Inspection of Bakeries

There were 1,468 inspections made in bakeries in various parts of the State. Several inspections were made to assist local inspectors or members of local boards of health. In some instances these inspections were made at the request of the local officers. Many bakeries which declined to clean up after hearing were prosecuted and convicted as the result of subsequent inspections.

During inspections made in Western Massachusetts, photographs were taken of conditions existing at that time. This procedure offset the defense occasionally employed. The baker under certain conditions would thoroughly clean the place and then invite the local health department to come in and look it over. The local health officer would then be summoned to give the results of his inspection after the place had been cleaned. The bakeries, however, are on the average operated as provided by law and regulation.

Carbonated Beverages

During the past year the inspectors made 307 inspections in 269 plants. As a result of these inspections there were four prosecutions, three of which resulted in conviction, and one person who had an extremely dirty plant was found not guilty. In 1939 fourteen persons were prosecuted, there being twenty cases in all. The figures show an improvement over conditions in prior years, but yet there is room for more improvement. There have been repeat inspections on certain plants where it was found necessary. The above inspections do not include many inspections which were made on spring water bottling establishments. In some small cities and towns it was necessary to make from three to five inspections. The reports of inspections vary with the time of inspection. If, for example, the plant is not in operation, the inspector can look over the inside of the pipe lines and the hose lines, etc. If, however, the plant is in operation the inspector cannot see the inside of the lines, but he can ascertain the conditions under which the work is performed, which he cannot do when the plant is not in operation. Some of the smaller plants are frequently locked up when the inspector is in the town, and occasionally five or six visits must be made to that town before the plant can be inspected.

A comparison of defects reported in 1939 and 1940 is interesting:

	1939	*1940*
Dirty walls	30	10
Dirty floors	24	20
Dirty sinks or no sink	23	19
Dirty toilets or washrooms	34	20
Dirty syrup rooms	62	31
Too many flies	8	7
Cap storage not as per regulations	15	4
Dirty pipe lines	14	10
Dirty hose lines	27	15
Washing machines not as per regulations	13	9
Total	250	145

In considering the above number of violations it should be understood that usually more than one violation exists in each plant where violations have been detected. Unfortunately, the syrup rooms are more liable to be dirty than the rest of the plant. The syrup room should be as clean as, if not cleaner, than the rest of the plant. It is in this room that the material to be placed in the bottles is prepared, and if prepared under unsanitary conditions there is great liability of contamination. There is altogether too much dependence placed upon the fact that carbon dioxide under pressure will kill bacteria.

The alkaline concentration of wash water shows an improvement compared with conditions found in 1939. In 1939, 56.5% of the wash water samples collected contained less than 2% of caustic alkali. In 1940, 36.4% of such samples contained less than 2% of caustic alkali. In 1940 this low strength alkali had an average caustic alkali content of 0.88%. Of the 66% of the samples containing 2% or more of caustic alkali the caustic alkali content was 3.13%, very nearly the 3.10 figure for the 1939 samples. The variation in 1940 was from 2.07 to 3.69 with two samples containing 4.71 and 6.19% of caustic alkali.

This we determine by the so-called double titration method. A definite quantity of the solution is titrated with tenth normal acid to the disappearance of the red color, using phenophthalein as the indicator. At this point the alkalinity of the solution is entirely in the form of sodium bicarbonate. Methyl orange indicator is then added, and the solution is further titrated to the usual red end point, and from these two figures the caustic alkali is determined. Samples which titrate low are tested again by adding some barium chloride solution prior to titration, which addition will precipitate carbonates, phosphates, and silicates, leaving the caustics in solution. Of the twelve samples titrated in this way, the difference between the two figures varied from −0.2 to +0.9. The double titration average was 0.87, and the titration using barium chloride was 0.82. The so-called ABC pills correspond to the barium chloride titration. The first pills added contain barium chloride or a similar substance and the second pills contain measured quantities of potassium acid sulphate. There is, however, another interfering substance which is not accounted for by either of these methods. Caustic alkali will dissolve aluminum, forming sodium aluminate which is not precipitated by barium chloride, and erroneous results will be obtained if during the course of bottle washing any aluminum which may be on the returned bottles gets into the hot caustic solution during the process of washing. This, however, is not a particularly serious error. The determination of the caustic alkali content of a washing solution cannot be made by means of a hydrometer.

Drugs

There were 171 samples of drugs collected and examined, of which 41 were found to be adulterated or misbranded. A sample of camphorated oil slightly deficient in camphor was obtained as was also a sample of tincture of iodine slightly deficient in iodine. The adulterated sample of hydrogen dioxide was very badly decomposed. The 19 samples of phenol solution contained considerably less than the amount specified upon the label. The spirit of nitrous ether samples were in most instances only slightly deficient in the active drug, but one very deficient sample was obtained, which resulted in a prosecution. The magnesium citrate solutions reported as adulterated were not made in accordance with the concentration specified in the pharmacopoeia. There were 2 samples of adulterated olive oil collected. These were labeled as "sweet oil" and were cottonseed oil. In accordance with the pharmacopoeia, the term "sweet oil" is synonymous with "olive oil." The magnesium citrate solutions were deficient in the active ingredients, and in one instance the manufacturer stated in court that he prepared the solution in that manner for the purpose of saving money. A summary of the drug analyses will be found in Table 9.

Miscellaneous Analyses

There were 110 miscellaneous chemical and 2,532 bacteriological examinations of samples made. Included in these figures are samples of special milk and Grade A raw milk which were not summarized in the table pertaining to the bacteriological examination of milk. There are also included the results of analyses of cream, frozen desserts, and goat milk of known purity. A number of analyses were made relative to material which allegedly was the cause of sickness. The results of these examinations will be found in Tables 7 and 8.

There were 344 samples of liquor submitted by police departments, the results of the analyses of which will be found in Table 10. The police departments also submitted 49 samples of narcotic drugs, chemicals, etc., for analysis, and 5 such samples were submitted by the Department of Conservation. These are listed in Table 10a.

Cold Storage

The results of the reports from the cold storage warehouses will be found in Tables 11, 12, 13, and 14. Comparing the average holdings with those of prior years, the 1940 figures show a decrease in the maximum holdings of butter, eggs, beef, pork, and lamb, and also a decrease in poultry holdings, except turkeys, which were considerably above the average. The high points and low points of the holdings of the different articles of food are representative of the seasonal variation in production of most of the articles but not all of the articles stored in Massachusetts.

	Low Point	High Point
Butter	May	October
Eggs	March	July
Broilers	June	January
Roasters	September	January
Fowls	June	January
Turkeys	November	February
Ducks	May	October
Pork	October	March

The beef and lamb holdings as well as those of broken out eggs show but little seasonal variation in the east. The seasonal variation of these articles is shown in the holdings throughout the entire country. Comparing these holdings with the population of the State, they are not excessive. The maximum per capita holdings in the State were:

Butter	1.1 pounds
Eggs	11 "
Broilers	0.1 pound
Roasters	0.6 "
Fowl	0.22 "
Turkeys	1.48 "
Ducks	0.25 "
Beef	0.43 "
Pork	1.1 "
Lamb	12 ounces

The tables showing the amounts placed in storage will give a better idea as to the quantity of cold storage food consumed but the actual holdings at any time are less than the requirements of the people of Massachusetts for food for one month. Table 15 shows the requests for extension of time in storage and the action of the Department thereon. In each instance the extension was granted because the articles were in proper shape for additional storage. Table 16 lists the articles which were ordered from storage by the Department after being in storage beyond the twelve months allowed.

Some bad turkeys found their way into cold storage and were confiscated. For information pertaining to this see the report pertaining to confiscations in Table 17.

Slaughtering Inspection

Under the slaughtering laws, each city and town, except Boston, is required each year to nominate one or more inspectors of slaughtering. These persons may be appointed after approval by the Department. One inspector does the bulk of this work. During the past year he made 370 visits to cities and towns and inspected 330 slaughterhouses during actual slaughtering operation.

There were 31 new men nominated for the position of inspector of slaughtering. These were all investigated, as the result of which 18 were disapproved because they did not have the necessary knowledge to make the post-mortem examination required by law. One inspector because of a violation of the law was suspended for a period of one month. The results of the slaughtering inspection will be found in Table 18.

In carrying out the laboratory work of the division there is more than one individual test or determination made upon each sample. Most of these determinations are quantitative. The total amount of tests or determinations computed from the amount of work done on each sample is as follows:

Milk, chemical	19,170
Milk, bacteriological	15,628
Foods, chemical	10,868
Miscellaneous samples, chemical	217
Miscellaneous samples, bacteriological	4,123
Drugs	205
Liquor	860
Narcotics, etc.	125
Total	51,196

Articles of Bedding and Upholstered Furniture

In connection with the work pertaining to bedding and upholstered furniture, one of the inspectors is assigned full time to that work, with occasional assistance from other members of the force. Another inspector spends part of his time on certain phases of this work, particularly that pertaining to the sterilization of feathers and secondhand material. The part-time services of one of the chemists are directed toward making chemical examinations, and one of the bacteriologists makes such bacteriological examinations as are deemed necessary.

During 1939, a law was passed requiring manufacturers and wholesalers residing elsewhere than in Massachusetts to obtain a permit from the Department in order that articles of bedding and upholstered furniture which they were handling could be sold in Massachusetts. The intent of this law was to stop the shipment of improperly labeled materials into the State by the refusal or the revocation of permits for cause. This law during the latter part of 1940 was declared to be unconstitutional, and the Department has recommended a repeal of the act rather than an amendment. The act was not working out as was expected. Many persons who obtained permits frequently continued to ship improperly labeled material into Massachusetts. There was no provision in the act, as in other similar acts, whereby the Department could refuse a permit, or if it revoked one for cause to refuse to issue a new one on payment of an additional fee.

The bedding law is violated more frequently than other laws enforced by the Department. There is an objection on the part of some manufacturers to label excelsior or secondhand material as such. There is too much cotton put into material labeled as wool, and oily mill wastes are seldom labeled as such.

There were a number of prosecutions, of which two resulted in findings of not guilty and two were dismissed for want of prosecution on motion of the inspector. In these latter instances the manufacturer was apprehended and convicted. Of the convictions six pertained to the use of secondhand material without being so declared, four pertained to improper labeling as to the character of material used for filling, and, in addition, nine cases related to pillows improperly labeled as to the content. Two cases involved the use of secondhand metal without being so specified as per a law passed in 1939. The fines in these cases varied from $10 to $200, with an average of $43 per case. In the cases involving upholstered furniture, there were two convictions for the use of secondhand material and eleven convictions for improper labeling or for selling furniture without a label. The fines in these cases varied from $10 to $25, with an average fine of $18.

The following are examples of improper labeling. Articles labeled as containing kapok were found to contain kapok and cotton. One article labeled as containing kapok and Egyptian comber was found to contain oily mill waste, with 13 per cent oil and grease. One article labeled as containing hair was found to contain a mixture of hair and sisal. A pillow labeled as containing cotton and down was found to contain cotton and sisal. One article labeled as containing felt without any designation as to the character of the felt was found to contain ground-up cloth. There were also a number of articles containing excelsior which were not so labeled.

Many of the fillings suspected of being secondhand were examined by means of the ultraviolet light and subsequently, if necessary, by chemical analysis to ascertain whether or not they contained secondhand material. Of the fifteen samples of filling so examined and declared to be secondhand or mixtures of new and secondhand material, the lowest urea content was 4.4 milligrams per 100 grams, the lower quartile was 9.0, the average exclusive of the highest sample was 9.5, the upper quartile was 13.8, and the highest was 222.6, which to say the least is decidedly excessive.[1]

There were many violations pertaining to the improper labeling of pillows as to the presence of down. Where the label bore a statement as to the percentages of the different substances in the mixture, it was apparently the desire of the manufacturer to mark the "down" up and to mark the feathers down. Pillows labeled as containing 10 to 25 per cent down contained only from 0.88 to 6.38 per cent down. Pillows which were labeled as containing "down" without any statement as to the presence of other material were found to contain 34, 35, 40, 43, 64, 88, and 91 per cent down, the balance in most instances being crushed feathers. Of these pillows the average down content was only 59.1 per cent. If this were milk, the addition of 41 per cent of water would seem to be excessive and would be resented by the purchaser.

The Department has taken the attitude that a reasonable amount of down must be placed in a pillow in order to justify the use of the word "down" upon the label. Ten cases of this nature were brought before the courts; and convictions were secured in Salem, Worcester, Malden, Somerville, and New Bedford. The above courts agreed with our attitude that unless the mixture contained more down than

[1] The urea determinations were made by the method of P. A. Racicot and H. C. Lythgoe, *Industrial and Engineering Chemistry*, Analytical Edition, 11: 512, 1939.

would actually be present as an irremovable impurity, the word "down" should not appear upon the label.

The Massachusetts law requires secondhand material and feathers to be sterilized. Persons operating sterilization establishments within the Commonwealth must obtain licenses from the Department of Public Health. A number of such licenses are in effect. In carrying out this work, one of the inspectors of the Department sees an article put into the sterilizing chamber, from which article he has removed a portion which he places in a sterile container. After the sterilization, he removes another portion which he places in another sterile container. Bacteria counts are then made on each of these samples, from which the efficiency of the process is determined. One license was suspended because of high counts in material labeled as sterilized and sold by the holder of the license. There were a number of repeat examinations made before the sterilizing process was operating sufficiently efficient so that the license could be reissued by the Department. In a few instances the sterilized material had a higher count than the unsterilized material. This may possibly have resulted from an uneven mixture of the dirty and clean portions of the material, together with an improper operation of the sterilizing process.

Of the twenty-six efficiency tests made the lowest efficiency was minus 130 per cent, the lower quartile was plus 1.4 per cent, the median was 57 per cent, the average 44.1 per cent, the upper quartile 90 per cent, and the maximum 99 per cent. Twenty-one samples of commercial material said to have been sterilized were examined. The lowest count was 4,000, the lower quartile was 42,000, the median 76,000, the geometric mean 100,500, the upper quartile 325,000, and the maximum 4,000,000. It is to be expected that the samples which have been commercially sterilized will have a count below 500,000. Four of these samples exceeded that figure. The counts on the feathers were higher, the lowest count being 148,000, the lower quartile 400,000, the median 740,000, the geometric mean 1,133,000, the upper quartile 2,000,000, and the maximum 26,000,000. With proper care the bacteria count on sterilized feathers should run considerably under 500,000.

Spectrographic Analyses in 1940

During the course of the year, considerable work has been done with the large Littrow all-quartz spectrograph. This work has consisted of qualitative and quantitative emission analyses, and qualitative absorption analyses. The greatest amount of time has been spent on quantitative emission analyses for lead in various foods.

Qualitative Analyses

The following qualitative emission analyses have been made:

Sample	Metal Sought	Total Samples	Number of Positive Results	Number of Negative Results
Pickles	Copper	1	–	1
Evaporated Milk	Lead	8	8	–
Jams and Jellies	Lead	8	2	6
Vinegar	Lead	57	56	1
Milk	Lead	33	9	24
Cream	Lead	12	8	4
Cider	Lead	20	18	2
Totals		139	101	38

The qualitative analyses were carried out by charring and partly ashing the samples and then burning the residues in cupped graphite electrodes using an arc of 9 amperes and 220 volts. The light from the arc is focussed by means of a quartz lens on the slit of the spectrograph, taking care that only the image of the central portion of the arc and not that of the hot electrodes falls on the slit. The slit width is set at about 0.01 mm. After passing through the slit, the light from the arc is rendered parallel, just before reaching the prism, by the collimating lens, which serves also as the focussing lens, and is then dispersed by the prism. Passing back through the collimating lens, it is focussed on the photographic plate held in the plate holder at the opposite end of the instrument. Lines are formed on the plate at points corresponding to the wave lengths of the light emitted by the elements present in the arc. The qualitative analyses depend on the fact that each element gives a set of lines at different wave lengths from those of any other element. Identification is, therefore, positive; and no possibility of confusion exists, as may occur in chemical analysis.

After exposure, the plate is developed, fixed, washed, and dried. Either panchromatic or process plates are used, depending on the spectral range to be covered. The presence or absence of the lines of the element sought are determined by inspection of the plate with a measuring magnifier.

Identification of the lines on the plate may be made by several methods. The simplest method is to juxtapose by means of the Hartmann diaphragm the lines of the element which is sought. Another useful method is to measure from a line which is always present in the particular sample (as, for instance, a calcium line in milk samples) and which is at a known distance from a line of the sought-for element. A more general method is to interpolate between previously identified lines of a juxtaposed iron spectrum. The Hartmann diaphragm is a device which allows successive adjacent vertical portions of the slit to be illuminated separately. This results in a series of juxtaposed spectra on the plate, in which lines of the same wave length are in perfect alignment throughout.

Quantitative Analyses

The following quantitative emission analyses for lead have been made:

Character of Sample	Number of Samples	P. P. M. Lead Maximum
Evaporated milk	8	1 ppm.
Apple jelly	2	1.1
Milk	9	1 ppm.
Cream	8	0.4 ppm.
Total	27	

Character of Samples	Cider	Cider Vinegar	Distilled or Spirit Vinegar	Malt Vinegar	Malt and Spirit Vinegar
Number of Samples	13[1]	49	5	1	1
Lowest	0.10	0.18	0.00	–	–
Lower quartile	0.18	0.37	–	–	–
Median	0.27	0.51	–	–	–
Average	0.43	0.55[1]	0.26	0.03	0.08
Geometric mean	0.32	0.50[2]	–	–	–
Upper quartile	0.54	0.78	–	–	–
Highest	1.50	11.80[3]	1.20	–	–

In addition, experiments have been carried out which indicate that it may be possible to use the spectrograph to advantage for the determination of arsenic in foodstuffs.

The vinegar samples were prepared for analysis by evaporating 25 cc. to dryness in platinum dishes and dissolving the residue in .5 cc. of dilute hydrochloric acid containing 1 mg. bismuth per cc. This solution was divided equally among three cupped graphite electrodes which had previously been treated with one drop of lead-free kerosene. The solutions were then evaporated to dryness.

The jelly samples were prepared by evaporating 10 gm. of jelly plus 2 cc. 10% hydrochloric acid to dryness in platinum dishes and ashing the residues at not over 950° F. The ash was dissolved in .5 cc. of sixth normal nitric acid containing 1 mg. bismuth per cc. This solution was divided among three electrodes and treated the same as the vinegar solutions.

Other samples were prepared by pipetting 25 cc. into a platinum dish and adding .5 cc. hydrochloric acid solution containing 1 mg. bismuth per cc. In the case of cider, .04 mg. of calcium in the form of calcium acetate was also added. The ash from cider contains considerable potassium as a metallic constituent; and since potassium has a low excitation potential, the energy of the arc is devoted principally

[1] Not including 5 samples containing less than 1 part per million.
[2] Exclusive of highest sample.
Including highest sample: Average = 0.78.
Geometric mean = 0.53.
[3] Duplicate determination by the dithizone method 8.0 p.p.m.

to the ionization of the potassium with insufficient potential available to excite the lead or bismuth atoms. The addition of calcium to the sample overcomes this effect sufficiently to bring out the lead and bismuth lines.

The above solutions were then evaporated to dryness, charred, and partly ashed. The residues were ground to a fine powder and transferred to cupped graphite electrodes.

All reagents, and water used for dilutions, must be rendered lead free by distillation in Pyrex stills, recrystallization, or precipitation of the lead with hydrogen sulphide after addition of copper as a coprecipitant. All apparatus and platinum dishes should be rinsed with hot nitric acid to remove any traces of lead.

After the above preparation, the samples are burned completely in an arc of 9 amperes and 220 volts. The light from the arc is passed first through a rotating logarithmic sector placed as close as possible to the slit of the spectrograph and then through a quartz lens placed immediately before the slit. The lens focusses an image of the arc on the collimating lens of the instrument and at this point, a diaphragm is inserted to mask out the images of the hot electrodes which would otherwise cause fog on the plate.

After development, the spectra on the plate are found to consist of lines of various lengths terminating sharply at the darker end and fading out gradually until they become invisible at the other end. Due to the fact that a sector cut in the form of a logarithmic curve was rotated in front of the slit during the exposure, the illumination along the length of the slit and also along the length of the line on the plate was varied logarithmically. Consequently the length of the line on the plate varies as the logarithm of the intensity of the light emitted at that wave length. The intensity of the light emitted varies as the concentration of the element in the sample, within the limits to which the method is applicable. These limits must be experimentally determined.

If all extraneous variables affecting the density of silver deposit on the plate could be controlled, the length of the line on the plate would be a direct measure of the concentration of the element in the sample. It is found, however, inconvenient or impossible to control exactly such factors as the excitation conditions in the arc, plate characteristics, development conditions, etc. Therefore, a reference element is added to the sample, the length of whose lines will vary to the same extent as those of the sought-for element under the influence of the uncontrolled variables. The difference in length of the reference and unknown lines is proportional to the difference in the logarithms of the intensities of light in the two lines. This difference in turn is equal to the logarithm of the ratio of the intensities. As the ratio of the intensities is proportional to the concentration of the unknown, the differences in line length may be plotted against the concentration of the unknown to give a working curve. By plotting against the logarithms of the concentrations, a straight line graph is obtained.

It is necessary to choose as a reference element one whose ease of excitation is the same as that of the unknown. The unknown and reference lines which are to be measured should be fairly close in wave length. In this work the bismuth line at 2898A and lead line at 2833A were used.

Before an analysis can be made, a working curve must be plotted from the results obtained by adding known amounts of lead to a lead-free sample of the foodstuff. In case a lead-free sample is unavailable, the working curve may still be obtained by assuming such an initial lead concentration as will give a straight line graph when the results are plotted. Due to the fact that extraneous elements may affect the intensities of the unknown and reference lines to a different extent, it is necessary to plot a fresh working curve for each type of sample. By making three to six exposures on each sample, the average error of an analysis may be reduced to 1 or 2 per cent. This accuracy is at least as good as that of the chemical method at low concentrations, and the time consumed is much less.

Absorption Work

Qualitative absorption analyses for foreign color in olive oil and in cider have been made. These analyses were carried out using a Bausch and Lomb spectrophotometer in conjunction with the spectrograph. In this instrument, light from substantially the same aspect of a condensed spark between tungsten steel electrodes is separated into two beams by two small lenses and suitable reflecting prisms. One beam, after passing through an absorption cell containing the clarified sample in suitable dilution, passes through a rotating sector of fixed aperture, which reduces its intensity to one-half. The other beam passes through an exactly similar cell containing the solvent only and then through a rotating sector of variable aperture, whose maximum aperture reduces the intensity to one-half. The two beams are then brought into juxtaposition by prisms and after passing through the spectrograph form two juxtaposed spectra on the plate.

A series of exposures are now made, in which the aperture of the variable sector is progressively reduced. When conditions are properly chosen, it will be found that at each setting of the variable sector, there will be a point or points on the corresponding juxtaposed spectra, at which the spectral lines of the two spectra are of equal density. Obviously, at the wave lengths at which these match points occur, the sample has absorbed an amount of light proportional to the reduction of the variable aperture. The extinction coefficients of the match points at the various aperture settings are now plotted against the wave lengths of the match points, expressed in millimicrons, to give an absorption curve. The extinction coefficient is defined as the logarithm of the ratio of the intensity of light entering the sample cell to that emerging from the cell. The cell length and concentration of the solution must also be specified in stating results.

In general, various substances will give different absorption curves. On these curves the location of the peaks and valleys with respect to wave length is characteristic of the substance under examination, while the height of the peaks is a measure of the concentration of the absorbing substance in the solution. The method may, therefore, be used for both qualitative and quantitative analyses. Quantitative analyses by this method may be made quite exact, but qualitative analyses are frequently uncertain because of similarities between the curves of different substances and interference by impurities.

TABLE 1. — *Prosecutions for Violations of the Food and Drug Laws*

For Sale of Milk not of Good Standard Quality

Name	Address	Court	Date	Result
Koziol, Joseph	Warren	Ware	June 28, 1940	Conviction

For Sale of Milk from Which a Portion of the Cream Had Been Removed

Name	Address	Court	Date	Result
New England Dairies Co., Inc.	Somerville	Somerville	Apr. 22, 1940	Discharged

For Sale of Milk Containing Added Water

Name	Address	Court	Date	Result
Brodeur, Armand	Woonsocket, R. I.	Uxbridge	May 9, 1940	Conviction
Davis, Francis	North Adams	North Adams	July 3, 1940	Conviction
Ferreira, John	Rehoboth	Taunton	Jan. 19, 1940	Dismissed
Ferreira, Sarah	Rehoboth	Taunton	Jan. 19, 1940	Conviction
Komak, Sigmund	Lynnfield	Malden	Dec. 15, 1939	Conviction
Morrisette, Fred	South Swansea	Fall River	Jan. 15, 1940	Conviction
Staniunas, Anthony	Marlborough	Marlborough	July 9, 1940	Conviction

Representing Unpasteurized Milk as Pasteurized

Name	Address	Court	Date	Result
Cabaceiras, Manuel	Fall River	Fall River	Apr. 30, 1940	Conviction
Dolinski, Frank	Westfield	Westfield	Oct. 19, 1940	Conviction
Fitzgerald, Thomas & Edward O'Rourke	Westfield	Westfield	Dec. 4, 1939	Conviction
Furtado, Manuel	Fall River	Fall River	Sept. 26, 1940	Conviction
George, Henry	Williamstown	Williamstown	July 12, 1940	Discharged
Houghton, Frank	Saxonville	Framingham	Nov. 7, 1940	Conviction
Kubli, Henry	Pittsfield	Pittsfield	Mar. 29, 1940	Conviction
Marsh, Ralph N.	Athol	Athol	Sept. 30, 1940	Conviction
McCarty, Thomas	Winchendon	Winchendon	Nov. 13, 1940	Conviction
Miller, Arthur	Methuen	Lawrence	July 12, 1940	Conviction[1]
Phillips, Richard C.	Orange	Athol	Nov. 25, 1940	Conviction
Pike, Samuel	Wilmington	Woburn	May 28, 1940	Dismissed
Pike, Jr., Samuel	Wilmington	Woburn	May 28, 1940	Conviction
Reynolds, Charles H.	Ludlow	Springfield	Aug. 27, 1940	Conviction[2]
Smead, Perley & Forrest	Greenfield	Greenfield	Dec. 1, 1939	Conviction
Williams, Wendell	East Longmeadow	Springfield	Jan. 19, 1940	Conviction

[1]Guilty, $20.00; suspended to January, 1941.

[2]Conviction, continued from day to day.

For Violation of Pasteurization Law and Regulations

Name	Address	Court	Date	Result
Dempsey, Raymond	Fitchburg	Fitchburg	Nov. 18, 1940	Conviction
Fairfield Farms, Inc.	Lynn	Lynn	Feb. 27, 1940	Conviction[1]
Goldman, Morris	Chelsea	Chelsea	Oct. 30, 1940	Dismissed
Hemenway, Fred	Williamsburg	Northampton	July 19, 1940	Conviction
Jalbert, Josephat A.	Southbridge	Southbridge	May 24, 1940	Conviction[2]
Kelleher, Edward	Newburyport	Newburyport	May 3, 1940	Conviction
Kelleher, William	Newburyport	Newburyport	May 3, 1940	Conviction
Vaidulas, Michael	Hubbardston	Gardner	Aug. 22, 1940	Conviction

For Violation of the Milk Grading Regulations

Bissell, Frank J.[3]	Holyoke	Holyoke	Jan. 18, 1940	Conviction
Bissell, Frank J.	Holyoke	Holyoke	July 11, 1940	Dismissed
Cote, Alfred (2 cases)	Chicopee	Chicopee	Jan. 12, 1940	Conviction
Jalbert, Josephat A. (2 cases)	Southbridge	Southbridge	May 24, 1940	Conviction[2]
Venetian Dairy, Inc.	North Adams	North Adams	July 3, 1940	Discharged

Butter

(Below the Legal Standard)

Anderson, James[5]	Beverly	Salem	May 10, 1940	Conviction
Anderson, James	Beverly	Salem	May 10, 1940	Conviction
Anderson, James	Beverly	Salem	May 10, 1940	Conviction[4]
Courtney, Francis[6]	Beverly	Salem	May 10, 1940	Conviction[4]
Courtney, Francis (3 cases)	Beverly	Salem	May 10, 1940	Conviction
Goldburg, Milton[6]	Beverly	Salem	May 10, 1940	Conviction[4]
Goldburg, Milton (3 cases)	Beverly	Salem	May 10, 1940	Conviction

For Sale of Adulterated or Misbranded Foods other than Milk and Milk Products

Clams

(Contained Added Water)

Atlantic & Pacific Tea Co., The Great	Quincy	Quincy	Oct. 18, 1940	Conviction
Stavis, Isadore W. (2 cases)	Chelsea	Roxbury	Sept. 6, 1940	Conviction
Supreme Market, Inc. (2 cases)	Wollaston	Quincy	Oct. 18, 1940	Discharged

Cream Cheese

(Below the Legal Standard)

Conestoga Cream & Cheese Mfg. Corp. (2 cases)	New York	Springfield	Apr. 3, 1940	Conviction
Lyondonville Creamery Ass'n.	Lyndonville, Vermont	Northampton	May 28, 1940	Conviction

Hamburg Steak

(Violation of the Law Relative to Use of Sodium Sulphite in Meat and Meat Products)

De Losa, Onofrio	Waltham	Waltham	Oct. 18, 1940	Conviction
Faria, Leo	Cambridge	Cambridge	Feb. 1, 1940	Conviction
First National Stores, Inc.	Salisbury	Amesbury	Aug. 30, 1940	Conviction
Matazzaro, Joseph	Quincy	Quincy	Sept. 5, 1940	Conviction
Matazzaro, Louis	Quincy	Quincy	Sept. 5, 1940	Conviction
Mucera, John	Somerville	Somerville	Dec. 1, 1939	Conviction
Smith, Donald W.	Newton	Newton	Oct. 16, 1940	Conviction[7]
Yarchin, Joseph	New Bedford	New Bedford	May 17, 1940	Conviction

[1]Fined $50—Appealed; Corporation dissolved.
[2]Guilty, $50 fine; suspended for two years.
[3]Fat less than 4.00 per cent.
[4]Sample collected by Mr. Knight of the U. S. Food and Drug Administration.
[5]Involving 2 cases of misbranding.
[6]Involving 3 cases of misbranding.
[7]Guilty, $25 fine; suspended to March, 1941.

For Sale of Adulterated or Misbranded Foods other than Milk and Milk Products — Concluded

Olive Oil

(Contained Edible Oil Other than Olive Oil)

Name	Address	Court	Date	Result
Basile, Joseph	Watertown	Cambridge	Sept. 30, 1940	Conviction
Biganzoli, Louis	Medford	Lawrence	Sept. 20, 1940	Conviction[1]
Central Meat & Grocery Co., Inc.	Southbridge	Southbridge	Nov. 22, 1940	Conviction
De Nucci, Michael	Springfield	Springfield	Oct. 14, 1940	Conviction
De Nucci, Michael (2 cases)	Springfield	North Adams	Oct. 29, 1940	Conviction
Gaglione, Michael	Cranston, R. I.	Boston	Nov. 9, 1940	Conviction
Grande, Vincent	Providence, R. I.	Framingham	Oct. 9, 1940	Conviction
Lavelli, August	Southwick	Westfield	Nov. 14, 1940	Conviction
Razzaboni, Evelina	Somerville	Somerville	Nov. 12, 1940	Conviction
Stefanilo, Clement D.	Malden	Chelsea	Nov. 14, 1940	Discharged
Stevens, James	Southbridge	Southbridge	Nov. 22, 1940	Conviction
Tiberri, James	Southbridge	Southbridge	Nov. 22, 1940	Conviction

Olive Oil

(Misbranded Oil)

Biganzoli, Louis	Medford	Lawrence	Sept. 20, 1940	Conviction[2]

Sausage

(Violation of the Law Relative to Use of Sodium Sulphite in Meat and Meat Products)

Atlantic & Pacific Tea Co., The Great	Orange	Orange	May 4, 1940	Conviction
Paperno, Jack	Springfield	Springfield	Oct. 10, 1940	Conviction
Slonka, Stanley	Ludlow	Springfield	Mar. 20, 1940	Conviction

Sausage

(Contained an Excessive Quantity of Soy Bean Flour)

Balkus Sausage & Provision Co., Inc.	Lynn	Lynn	Feb. 29, 1940	Conviction
Boepple Co., George, Inc.	Worcester	Worcester	May 16, 1940	Conviction
Brockelman Bros., Inc., (2 cases)	Worcester	Worcester	July 26, 1940	Conviction
Cavigioli Packing Co., Inc.	Milford	Milford	Apr. 8, 1940	Conviction
Colonial Provision Co., (2 cases)	Boston	Boston	July 30, 1940	Conviction
Omaha Packing Co., Inc.	Lowell	Lowell	Apr. 3, 1940	Conviction
Omaha Packing Co., Inc.	Lowell	Lowell	Apr. 3, 1940	Dismissed
Omaha Packing Co., Inc. (2 cases)	Lowell	Southbridge	May 24, 1940	Conviction
Weiner, Alice H. (2 counts)	Boston	Boston	July 24, 1940	Conviction
Wohrle, John J.	Pittsfield	Pittsfield	May 14, 1940	Conviction

Vinegar

(Violation of Law Pertaining to Vinegar)

Sulkin Spice Co.,	Boston	Boston	Dec. 29, 1939	Conviction
Sulkin Spice Co. (2 cases)	Boston	East Boston	June 25, 1940	Conviction
Sulkin Spice Co. (3 cases)	Boston	Worcester	June 28, 1940	Conviction

For Sale of Decomposed Food

Butter

Miller, Isadore Jack	New Bedford	New Bedford	Nov. 15, 1940	Conviction[3]

Bacon

Economy Grocery Stores Corp.	Springfield	Springfield	Sept. 24, 1940	Conviction
United Meats, Inc.	Springfield	Springfield	Sept. 24, 1940	Conviction

Chicken

Economy Grocery Stores Corp. (2 cases)	Springfield	Springfield	Sept. 24, 1940	Conviction

[1]Guilty, $10 fine; suspended to March, 1941.
[2]Guilty, $25 fine; suspended to March, 1941.
[3]Appealed.

For Sale of Decomposed Food — Continued

Hamburg Steak

Name	Address	Court	Date	Result
Atter, Charles P.	Gardner	Athol	May 20, 1940	Discharged
Atter, Joseph	Gardner	Athol	May 20, 1940	Discharged
Cohen, Joseph	Amesbury	Amesbury	Aug. 9, 1940	Conviction
Colonial Super Market, Inc.	Waltham	Waltham	Oct. 18, 1940	Conviction
Fall River Public Market, Inc.	Fall River	Fall River	June 5, 1940	Conviction
Freedman, Joseph	Roxbury	Roxbury	July 12, 1940	Conviction
Freedman, Joseph	Roxbury	Roxbury	Oct. 7, 1940	Conviction
Granitone Market, Inc.	Quincy	Quincy	Oct. 31, 1940	Conviction
Gula, Matthew J.	Easthampton	Northampton	Oct. 11, 1940	Conviction
Lussier, Elzear	Fall River	Fall River	Nov. 7, 1940	Conviction
Lussier, Godiace	Fall River	Fall River	Nov. 7, 1940	[1]
Miller, Isadore J.	New Bedford	New Bedford	June 11, 1940	Conviction[2]
New England Markets, Inc.	Cambridge	Cambridge	Oct. 14, 1940	Conviction
Paul, Mrs. Goldie (2 cases)	Roxbury	Roxbury	July 26, 1940	Conviction
Ploski, Chester	Norwood	Dedham	Jan. 19, 1940	Conviction
Pow-ow River Market, Inc.	Amesbury	Amesbury	Aug. 9, 1940	Conviction
Rabinovitz, Harry	Roxbury	Roxbury	July 12, 1940	Conviction
Ritter, David	Westfield	Westfield	Dec. 8, 1939	Conviction
Smith, Donald W.	Newton	Newton	Oct. 16, 1940	Conviction
South Cash Market, Inc.	Boston	Boston	Aug. 28, 1940	Conviction[2]
Streisfield, Louis	Amesbury	Amesbury	Aug. 30, 1940	Conviction
Taunton Public Market, Inc.	Taunton	Taunton	July 12, 1940	Conviction
Veines, Arthur	Amesbury	Amesbury	Sept. 10, 1940	Conviction

Lamb Patties

Name	Address	Court	Date	Result
Brockelman Bros., Inc.	Framingham	Framingham	June 11, 1940	Conviction
Economy Grocery Stores Corp.	Fall River	Fall River	Nov. 7, 1940	Conviction
Fall River Public Market, Inc.	Fall River	Fall River	June 5, 1940	Conviction
First National Stores, Inc.	New Bedford	New Bedford	Nov. 25, 1940	Conviction

Meat

Name	Address	Court	Date	Result
Miller, Isadore J.	New Bedford	New Bedford	Nov. 15, 1940	Conviction[2]

Pork Chops

Name	Address	Court	Date	Result
Fall River Public Market, Inc.	Fall River	Fall River	June 5, 1940	Conviction

Sausage and Sausage Meat

Name	Address	Court	Date	Result
Anderson, C. F., Inc. (2 cases)	Brockton	Brockton	Apr. 11, 1940	Conviction
Atter, Charles	Gardner	Gardner	Jan. 18, 1940	Conviction
Atter, Joseph	Gardner	Gardner	Jan. 18, 1940	Conviction
Big Four, Inc., The	North Adams	North Adams	Oct. 17, 1940	Discharged
Bloom, Edward	Newburyport	Newburyport	Oct. 21, 1940	Conviction[2]
Bonkowski, Stanley	Westfield	Westfield	Nov. 13, 1940	Conviction
Bradley, Alfred B.	South Deerfield	Greenfield	Oct. 9, 1940	Conviction
Brockelman Bros., Inc.	Gardner	Gardner	Jan. 11, 1940	Discharged
Brockelman Bros., Inc.	Gardner	Athol	May 20, 1940	Discharged
Brockelman Bros., Inc.	Worcester	Worcester	June 21, 1940	Conviction
Brockton Public Market, Inc.	Brockton	Brockton	Feb. 8, 1940	Conviction
Chagnon, Nathalie	Gilbertville	East Brookfield	Nov. 4, 1940	Conviction
Chubet, Bernard A.	Norwood	Dedham	Jan. 31, 1940	Conviction
Del Vecchio & Arpaio, Inc.	Springfield	Springfield	July 9, 1940	Conviction
Drapkin, Joseph	Waltham	Waltham	Jan. 8, 1940	Conviction
Dzialo, John	Southampton	Northampton	Oct. 11, 1940	Conviction
Economy Grocery Stores Corp.	Cambridge	East Cambridge	Aug. 16, 1940	Discharged
Economy Grocery Stores Corp.	Springfield	Springfield	Sept. 24, 1940	Conviction
Economy Grocery Stores Corp.	Cambridge	East Cambridge	Oct. 1, 1940	Conviction
Economy Grocery Stores Corp.	Fall River	Fall River	Nov. 7, 1940	Conviction
Fall River Public Market, Inc.	Fall River	Fall River	Jan. 29, 1940	Conviction
First National Stores, Inc. (3 cases)	New Bedford	New Bedford	May 31, 1940	Conviction
Frenier, Henry	Pittsfield	Pittsfield	June 5, 1940	Conviction
Grady, Mary V.	Salem	Salem	Aug. 29, 1940	Conviction
Granitone Market, Inc.	Quincy	Quincy	Oct. 31, 1940	Conviction

[1]Probation until April 30, 1941.
[2]Appealed.

For Sale of Decomposed Food — Concluded

Sausage and Sausage Meat—Concluded

Name	Address	Court	Date	Result
Grenier, Aime G.	Huntington	Northampton	Oct. 4, 1940	Conviction
Growers Outlet, Inc.	Holyoke	Holyoke	July 3, 1940	Conviction
Growers Outlet, Inc.	Springfield	Springfield	Sept. 24, 1940	Conviction
Kronick, Simon	North Adams	North Adams	Oct. 17, 1940	Discharged
Leavitt, Harry	North Adams	North Adams	Oct. 17, 1940	Discharged
Lodgen, Elick	Quincy	Quincy	Sept. 5, 1940	Dismissed
Magidson, Saul	Springfield	Springfield	Oct. 22, 1940	Conviction
Massachusetts Mohican Co., The	Salem	Salem	Sept. 11, 1940	Conviction
Matazarro, Joseph	Quincy	Quincy	Sept. 5, 1940	Conviction
Matazarro, Louis	Quincy	Quincy	Sept. 5, 1940	Conviction
Merritt, Theodore W.	Orange	Orange	Dec. 8, 1939	Conviction
Mihos, Christy	Brockton	Brockton	Apr. 11, 1940	Conviction
Morretti, Umberto	Taunton	Taunton	July 12, 1940	Discharged
Neal, Malcolm	Springfield	Springfield	July 25, 1940	Conviction
Obertuck, John	Gilbertville	East Brookfield	Nov. 4, 1940	Conviction
Omaha Packing Co., Inc.	Lowell	Lowell	Apr. 3, 1940	Dismissed
Perdikis, Alexander	Webster	Webster	July 2, 1940	Conviction
Phillips, A. H., Inc.	Belchertown	Northampton	May 3, 1940	Conviction
Posovsky, Ted	Orange	Orange	May 1, 1940	Conviction
Rajewski, Joseph	Easthampton	Northampton	Oct. 11, 1940	Conviction
Rich, Walter L.	North Adams	North Adams	Oct. 17, 1940	Discharged
Richstein, Harry	Quincy	Quincy	June 6, 1940	Conviction
Richstein, Harry	Quincy	Quincy	Sept. 5, 1940	Conviction
Richton, Arthur	North Adams	North Adams	Oct. 17, 1940	Discharged
Ritter, David	Westfield	Westfield	Dec. 8, 1939	Conviction
Rodney, Joe	Roxbury	Roxbury	Oct. 7, 1940	Conviction
Sawyer, Morris	Taunton	Taunton	Sept. 13, 1940	Conviction
Selvecki, Charles	Florence	Northampton	July 23, 1940	Conviction
Snyder, Joseph N. (2 cases)	Fall River	Fall River	May 28, 1940	Conviction
Spitzler Co., The Oscar, Inc.	Holyoke	Holyoke	July 8, 1940	Conviction
Taunton Public Market, Inc.	Taunton	Taunton	July 12, 1940	Conviction
Union Foodland, Inc.	New Bedford	New Bedford	Nov. 25, 1940	Conviction[1]
Vinick, George	Springfield	Springfield	July 25, 1940	Conviction
Wagner, John	Springfield	Springfield	Oct. 10, 1940	Conviction
Wholesale Grocery Co., Inc.	Springfield	Springfield	Oct. 25, 1940	Conviction

Turkey

Name	Address	Court	Date	Result
Economy Grocery Stores Corp.	Springfield	Springfield	Sept. 24, 1940	Conviction

For Sale of Food Containing Filthy Animal or Vegetable Substances

Split Peas

Name	Address	Court	Date	Result
Commonwealth Grocery Co.	Somerville	Somerville	Jan. 12, 1940	Conviction

For Violation of Sanitary Food Law

Name	Address	Court	Date	Result
Pilgrim Restaurant, Inc. (2 cases)	Hyannis	Barnstable	Aug. 14, 1940	Conviction
Pow-ow River Market, Inc.	Amesbury	Amesbury	Aug. 9, 1940	Discharged
Rust, Howard S. (2 cases)	Falmouth	Barnstable	July 31, 1940	Conviction

For Violation of Bakery Laws

Name	Address	Court	Date	Result
Bikofsky, Max	Boston	Boston	Jan. 26, 1940	Conviction
Boston Baking Co., Inc.	Roxbury	Roxbury	Mar. 8, 1940	Conviction
Calder, William	Webster	Webster	Aug. 13, 1940	Conviction
Dundulis, Joseph	Norwood	Dedham	Jan. 26, 1940	Conviction
Evanski, Frank	Webster	Webster	Mar. 12, 1940	Conviction
Kilkus, Mary	Brockton	Brockton	May 2, 1940	Conviction
Rosenberg, Myer	Holyoke	Holyoke	Mar. 13, 1940	Conviction
Rosenberg, Myer (2 cases)	Holyoke	Holyoke	Aug. 27, 1940	Conviction
Schwartz, Louis (2 cases)	Lawrence	Lawrence	May 23, 1940	Conviction
Touloumzis, Nicholas	Boston	Roxbury	Jan. 23, 1940	Conviction
Weintraub, Bertha	Malden	Malden	July 25, 1940	Conviction

For Violation of Frozen Dessert Law or Regulations Made Thereunder

Name	Address	Court	Date	Result
Beverly Farms Ice Cream Co., Inc.	Boston	West Roxbury	Nov. 29, 1940	Conviction
Restuccia, Angela	Dorchester	Dorchester	Oct. 29, 1940	Conviction

[1]Appealed.

For Violation of Law and Regulations Relative to the Manufacture and Bottling of Carbonated Nonalcoholic Beverages, Soda Water, Mineral and Spring Water

Name	Address	Court	Date	Result
Argeros, John	Peabody	Peabody	Feb. 9, 1940	Conviction
Bloomberg, Benjamin	Chelsea	Chelsea	Feb. 26, 1940	Discharged
Commander Beverage Co., Inc.	Sudbury	Framingham	Apr. 29, 1940	Conviction
Girouard, Donald T.	Winchendon	Winchendon	Mar. 19, 1940	Conviction
Simon, Abraham	Chelsea	Chelsea	Feb. 26, 1940	Conviction

For Sale of Adulterated or Misbranded Drugs not Conforming to the Requirements of the U. S. Pharmacopoeia

Brosseau, William S.	Chicopee	Chicopee	Feb. 21, 1940	Conviction
Hebert Drug Co., Inc.	Holyoke	Holyoke	Feb. 23, 1940	Conviction
Hughes, James M.	Pittsfield	Pittsfield	Apr. 5, 1940	Conviction
Jameson, Robert	Springfield	Springfield	Jan. 16, 1940	Conviction
Le Clair, Donat T.	Holyoke	Holyoke	Feb. 23, 1940	Conviction
Loiselle, Elzear A.	Chicopee	Chicopee	Mar. 27, 1940	Discharged
Poust, David	Brookline	Brookline	Mar. 22, 1940	Conviction
Sexton Drug Co., Inc.	Springfield	Springfield	Mar. 20, 1940	Conviction
Summit Pharmacy, Inc.	Brookline	Brookline	Mar. 1, 1940	Conviction

For Violation of the Laws Relative to Slaughtering

Sfreddo, Umberto	Southbridge	Southbridge	Aug. 21, 1940	Conviction
Zygmuntowicz, Andrew	Uxbridge	Blackstone	July 12, 1940	Conviction

For Violation of Law Pertaining to Bedding and Upholstered Furniture

Aronson, Sadie	Dorchester	Boston	Aug. 6, 1940	Conviction
Brenner, John	New Haven, Conn.	Springfield	Apr. 26, 1940	Conviction
Burton-Dixie Corp.	Newark, N. J.	Dedham	Aug. 1, 1940	Discharged
Byer, Philip J.	Brookline	Boston	Aug. 6, 1940	Conviction
Cohen, Reuben H.	Manchester, N. H.	Brockton	Apr. 4, 1940	Conviction
Cohen, Sarah	Manchester, N. H.	Brockton	Apr. 4, 1940	Dismissed
Columbia Feather Co.	Chicago, Ill.	Quincy	Nov. 8, 1940	Conviction
Comfort Pillow & Feather Co.	Somerville	Somerville	July 22, 1940	Conviction
Comfort Pillow & Feather Co.	Somerville	Somerville	Oct. 15, 1940	Conviction
Diamond Mattress Co., M., Inc.	Woonsocket, R. I.	New Bedford	Jan. 5, 1940	Conviction
Gershman, George L.	Worcester	Fall River	Mar. 13, 1940	Conviction
Glickman, Harold	Newton	Malden	June 7, 1940	Conviction
Goldstein, Lillian R.	Dorchester	Boston	Aug. 6, 1940	Conviction
Goodman Co., I.	Boston	Boston	Dec. 22, 1939	Discharged
Hadley Co., The	Worcester	Worcester	May 2, 1940	Conviction
Hadley Co., The	Springfield	Springfield	July 30, 1940	Conviction
Hovey Co., C. F.	Boston	Boston	June 7, 1940	Conviction
Kane Co., The	Worcester	Worcester	June 14, 1940	Conviction
Kane Co., The	Worcester	Worcester	June 14, 1940	Conviction[1]
Lahikainen, Henry	Gardner	Gardner	July 18, 1940	Conviction
Metropolitan Furniture Co.	Springfield	Springfield	Apr. 16, 1940	Conviction
Miller, David D.	Springfield	Springfield	Mar. 29, 1940	Conviction
Montgomery Ward & Co., Inc.	Greenfield	Greenfield	July 31, 1940	Conviction
Morgan's, Inc.	Boston	Boston	July 12, 1940	Conviction
Pilgrim Upholstering Co.	Hyde Park	Plymouth	Nov. 15, 1940	Conviction
Reliable Upholstering Corp.	Cambridge	Roxbury	Nov. 25, 1940	Conviction
Rudd Furniture Co., Inc.	Haverhill	Haverhill	Mar. 19, 1940	Conviction
Sanitary Feather & Down Co., Inc.	Brooklyn, N. Y.	Fitchburg	Jan. 30, 1940	Defaulted
Sears, Roebuck & Co.	Quincy	Quincy	Nov. 8, 1940	Dismissed
Sobel, Jacob	Worcester	Worcester	June 28, 1940	Conviction
South End Bed Spring Co., Inc.	South Boston	Worcester	Aug. 29, 1940	Conviction
Takas, James	New Haven, Conn.	Springfield	Apr. 26, 1940	Conviction
United Bedding Mfg. Co.	Passaic, N. J.	Fall River	Feb. 20, 1940	Conviction
Waitt, Adam	Brockton	Brockton	June 18, 1940	Conviction
Wayland Mfg. Co.	Providence, R. I.	Brockton	Feb. 23, 1940	Conviction

Obstruction of an Inspector of the Department of Public Health

Morretti, Umberto	Taunton	Taunton	July 12, 1940	Conviction

Obstruction of a Local Slaughtering Inspector

Cohen, Morris	New Bedford	New Bedford	June 28, 1940	Conviction

[1] Appealed.

Table 2. — *Summary of Milk Statistics*

Number of samples above standard	4,946
Number of samples below standard	411
Total samples	5,357
Number having more than 15% solids	63
Number having between 14% and 15% solids	334
Number having between 13% and 14% solids	1,637
Number having between 12% and 13% solids	2,932
Number having between 11% and 12% solids	384
Number having between 10% and 11% solids	22
Number having between 9% and 10% solids	3
Number having between 8% and 9% solids	2
Number showing removal of cream	51
Number showing addition of water	45

Table 3. — *Average Composition of Milk Samples*

	Total Samples				Samples Not Found Adulterated			
	Number of Samples	Total Solids	Fat	Solids not Fat	Number of Samples	Total Solids	Fat	Solids not Fat
		%	%	%		%	%	%
December	336	12.96	4.04	8.92	331	13.00	4.06	8.94
January	560	13.20	4.21	8.99	557	13.21	4.22	8.99
February	488	13.03	4.12	8.91	485	13.09	4.14	8.95
March	655	12.79	3.97	8.82	625	12.86	3.99	8.87
April	525	12.78	4.00	8.78	520	12.79	4.01	8.78
May	585	12.86	4.03	8.83	581	12.87	4.03	8.84
June	495	12.92	4.07	8.85	488	12.94	4.07	8.87
July	489	12.55	3.89	8.66	478	12.58	3.91	8.67
August	336	12.61	3.90	8.71	336	12.61	3.90	8.71
September	355	12.74	4.03	8.71	355	12.74	4.03	8.71
October	261	13.13	4.12	9.01	261	13.13	4.12	9.01
November	272	12.97	4.09	8.88	271	12.98	4.07	8.91
Average for year	5,357	12.88	4.04	8.84	5,288	12.89	4.05	8.84

Table 4. — *Variation in Total Solids of Milk Collected in Different Parts of the State*

% Solids	% Samples Collected in Eastern Massachusetts	Western Massachusetts	Southern Berkshire District	Grade A	Certified
8	0.06	–	–	–	–
9	0.10	–	–	–	–
10	0.45	0.43	–	–	–
11	9.39	4.70	1.03	–	–
12	62.62	48.19	22.34	13.46	50.39
13	24.43	36.00	48.83	62.69	49.61
14	2.59	9.12	21.83	21.92	–
15	0.35	1.57	5.97	1.93	–
Average Solids	12.69	13.05	13.56	13.50	12.91
Average Fat	3.98	4.07	4.32	4.42	4.10
Total Samples	3,119	1,853	385	258	129

Table 5. — *Summary of Bacteriological Examinations of Milk*

	Samples Examined in Boston	Samples Examined in Westfield	Samples Collected in Southern Berkshire District
Certified Milk			
Total Samples	72	10	–
Samples with count below 10,000	72	9	–
Highest count	8,500	12,700	–
Lowest count	500	500	–
Geometric mean	2,454	4,100	–
Pasteurized Certified Milk			
Total Samples	61	3	–
Samples with count below 500	60	2	–
Highest count	590	18,400	–
Lowest count	Less than 10	100	–
Geometric mean	32	700	–

TABLE 5.—*Summary of Bacteriological Examinations in Milk*—Concluded

	Samples Examined in Boston	Samples Examined in Westfield	Samples Collected in Southern Berkshire District
GRADE A RAW MILK			
Total samples	65	31	–
Samples with counts less than 100,000	63	31	–
Highest count	140,000		–
Lowest count	Less than 1,000		–
Geometric mean	10,210	35,500	–
GRADE A PASTEURIZED MILK			
Total samples	174	129	5
Samples with counts less than 10,000	143	86	4
Highest count	922,000	6,000,000	10,800
Lowest count	100	100	600
Geometric mean	1,992	5,300	2,100
PASTEURIZED MILK			
Total samples	1,908	1,107	35
Samples with count below 25,000	1,192	574	32
Samples with count below 40,000	1,356	718	33
Highest count	5,600,000	6,500,000	114,000
Lowest count	Less than 100	100	100
Geometric mean	13,198	22,500	4,600
RAW MILK SOLD AS SUCH			
Total samples	294	369	326
Samples with count below 100,000	213	219	264
Samples with count below 400,000	269	294	307
Highest count	1,000,000	4,410,000	3,800,000
Lowest count	1,000	400	1,100
Geometric mean	43,874	73,300	27,900
RAW MILK TO BE PASTEURIZED			
Total samples	2,239	967	15
Samples with counts below 100,000	1,406	623	14
Samples with counts below 250,000	1,722	742	14
Samples with counts below 400,000	1,877	810	15
Highest count	13,000,000	50,000,000	306,000
Lowest count	Less than 1,000	1,000	1,500
Geometric mean	53,496	62,200	10,700

TABLE 6. — *Summary of Analyses of Food Samples*

CHARACTER OF SAMPLE	Not Declared Adulterated or Misbranded	Adulterated or Misbranded	Total
Alimentary pastes	3	–	3
Butter	23	7	30
Buttermilk	1	–	1
Candy	1	–	1
Cereals	19	–	19
Cheese and cream cheese	16	14	30
Cider	16	4	20
Clams	37	14	51
Cream	317	8	325
Condimental sauces	–	1	1
Dried beans and peas	6	1	7
Eggs	7	1	8
Evaporated milk	8	–	8
Fish	5	1	6
Flour	3	–	3
Frozen desserts	297	–	297
Fruit (for spray residue)	16	–	16
Fruit juices	22	–	22
Jams and jellies	8	–	8
Maple products	12	3	15
Meat products:			
Bacon	2	2	4
Corned beef	1	1	2
Hamburg steak	137	49	186
Lamb patties	9	5	14
Meat loaf	6	1	7
Pork liver and kidneys	2	–	2
Pork	12	5	17
Poultry and game	1	4	5
Stew beef	3	–	3
Sausages	245	135	380
Mince meat	2	–	2
Veal	–	1	1

Table 6.—*Summary of Analyses of Food Samples*—Concluded

Character of Sample	Not Declared Adulterated or Misbranded	Adulterated or Misbranded	Total
Milk powder	2	–	2
Molasses	1	–	1
Olive oil	111	40	151
Oysters	6	2	8
Pastry	1	–	1
Peanuts	1	–	1
Pickles and relishes	6	4	10
Scallops	34	13	47
Shrimp	4	12	16
Soft drinks	51	15	66
Soy bean meal and other sausage "binders"	11	–	11
Tea	1	–	1
Vinegar	54	11	65
Totals	1,520	354	1,874

Table 7. — *Miscellaneous Bacteriological Examinations*

Character of Sample	Satisfactory	Unsatisfactory	Total Samples
Special milk, raw and pasteurized	19	2	21
Grade A raw milk	32	7	29
Frozen desserts	274	35	309
Cream	209	89	296
Known purity goat milk	189	–	189
Miscellaneous food samples:			
Milk beverages	10	1	11
Soft drinks	3	–	3
Candy	1	–	1
Crab meat	2	5	7
Miscellaneous samples other than food:			
Mattress filling	83	17	100
Milk can drainings	2	11	13
Empty bottles	3	4	7
Direct microscopic counts on milk samples	–	–	986
Plate counts on samples pasteurized in the laboratory	–	–	560
Total samples			2,532

Table 8. — *Miscellaneous Chemical Analysis*

Character of Sample	Legal	Illegal	Total
Caustic poisons	1	–	1
Chlorine bleach	1	–	1
Silver polish	1	–	1
Washing solution (2% caustic or more)	30	12	42
Filling for articles of bedding, etc.	13	52	65
Totals	46	64	110

Table 9. — *Summary of Analyses of Drug Samples*

Character of Sample	Legal	Illegal	Total
Alcohol	1	–	1
Argyrol solution	1	–	1
Aromatic spirit of ammonia	1	–	1
Camphorated oil	3	1	4
Camphorated tincture of opium	4	–	4
Carron oil	2	–	2
Castor oil	1	–	1
Olive oil	3	2	5
Hydrogen dioxide solution	1	1	2
Magnesium citrate solution	14	12	16
Mercurochrome solution	6	–	6
Phenol	17	–	17
Phenol solution	36	19	55
Prescriptions	2	–	2
Spirit of camphor	11	–	11
Spirit of nitrous ether	20	5	25
Spirit of peppermint	2	–	2
Tincture of iodine	3	1	4
Wintergreen oil	2	–	2
Totals	130	41	171

Table 10. — *Character of Samples*

Cities and Towns	Beer	Cider	Wine	Distilled Spirits	Alcohol	Misc.	Total
Boston	11	–	9	63	9	3	95
Lynn	2	–	–	7	3	–	12
Springfield	3	–	–	11	–	–	14
A. B. C. Commission	58	–	8	92	6	–	164
Dept. Public Safety	1	–	–	–	–	–	1
Miscellaneous[1]	7	1	1	45	4	–	58
Total	82	1	18	218	22	3	344

[1] From 26 cities and towns submitting less than 10 samples each.

Table 10a. — *Character of Samples*

	Cannabis	Ergot	Heroin	Morphine	Opium	Strychnine	Containing no Narcotics	Total
Capsules	–	–	–	–	–	–	1	1
Cigarettes	5	–	–	–	–	–	3	8
[1]Corn, grains	–	–	–	–	–	3	2	5
Cotton, piece	–	–	–	–	–	–	1	1
Herbs	–	–	–	–	–	–	1	1
Gum, black	–	–	–	–	2	–	–	2
Liquid	–	1	–	–	1	–	–	2
[2]Meat	–	–	–	–	–	–	1	1
Paste, brown	–	–	–	–	1	–	–	1
Pills:								
White	–	–	–	1	–	–	1	2
Brown	–	–	–	–	1	–	–	1
Powder, white	–	–	15	5	–	–	7	27
Rinsings from medicine dropper	–	–	–	1	–	–	–	1
Seeds, hemp	–	–	–	–	–	–	1	1
Total	5	1	15	7	5	3	18	54

[1] Submitted for poisons by Department of Fisheries and Game.
[2] Submitted for poisons by the Department of Conservation.

TABLE 11. — *Articles Other than Fish Placed in Cold Storage from December 1, 1939, to December 1, 1940*

	Butter (lbs.)	Eggs (Dozens)	Broken-out Eggs (lbs.)	Broilers (lbs.)	Roasters (lbs.)	Fowls (lbs.)	Turkeys (lbs.)	Ducks (lbs.)	Miscellaneous Poultry (lbs.)	Beef (lbs.)	Pork (lbs.)	Lamb and Mutton (lbs.)	Miscellaneous Meats (lbs.)
December	242,797	36,930	679,834	96,740	1,031,125	326,125	4,236,624	29,168	456,057	507,305	2,087,511	119,198	1,004,920
January	581,519	52,590	660,030	164,712	438,030	222,278	2,274,928	12,549	268,606	494,219	1,911,520	60,267	1,204,712
February	318,067	26,430	770,190	129,477	355,038	227,611	1,097,727	23,486	154,062	424,850	1,936,837	109,517	920,081
March	237,215	298,380	706,005	121,799	384,943	211,999	695,362	16,516	156,839	632,930	812,902	39,322	660,989
April	323,600	1,836,240	2,036,637	87,277	251,325	383,196	568,270	12,954	194,025	331,726	685,144	68,709	669,405
May	1,033,686	2,230,110	1,943,704	88,835	111,680	229,903	1,104,250	147,660	225,318	634,203	651,842	74,858	913,146
June	3,455,719	485,430	1,092,375	12,845	108,130	391,707	958,131	293,454	200,597	308,678	567,355	60,502	756,804
July	1,490,953	378,960	1,262,004	98,459	34,977	332,185	405,917	423,244	118,066	318,977	1,140,593	74,293	734,751
August	562,441	227,670	789,093	104,502	40,430	276,193	363,355	251,837	108,409	402,108	1,718,020	43,711	689,693
September	337,322	265,140	725,370	193,441	371,070	353,238	244,668	116,807	236,009	324,727	793,539	60,506	753,719
October	552,846	311,550	983,191	138,268	747,060	563,256	322,932	39,095	236,988	398,020	747,770	147,849	972,396
November	285,469	345,780	688,279	100,480	812,849	382,686	2,316,843	19,603	297,129	851,643	1,594,857	186,233	1,883,521

TABLE 12. — *Articles Other than Fish on Hand in Cold Storage on the First Day of the Month, from January 1, 1940, through December 1, 1940*

	Butter (lbs.)	Eggs (Dozens)	Broken-out Eggs (lbs.)	Broilers (lbs.)	Roasters (lbs.)	Fowls (lbs.)	Turkeys (lbs.)	Ducks (lbs.)	Miscellaneous Poultry (lbs.)	Beef (lbs.)	Pork (lbs.)	Lamb and Mutton (lbs.)	Miscellaneous Meats (lbs.)
January	617,420	59,700	1,383,983	514,202	2,945,364	985,183	4,670,552	595,808	566,626	1,722,451	2,875,176	208,067	1,493,559
February	566,637	16,260	1,121,469	466,751	2,855,121	777,332	6,466,026	391,916	560,840	1,785,353	3,552,503	156,205	1,853,927
March	470,633	2,400	948,965	398,140	2,439,017	433,193	6,514,048	211,270	458,043	1,741,495	4,916,180	214,071	1,818,503
April	269,397	268,590	709,770	350,293	2,040,953	205,395	5,634,798	16,374	355,057	1,995,758	4,570,335	183,142	1,739,770
May	238,986	2,015,220	1,738,978	197,744	1,300,633	149,912	4,958,429	9,907	287,377	1,485,427	3,963,000	137,415	1,271,310
June	1,010,839	4,171,650	2,568,266	75,698	623,183	162,806	4,941,882	152,274	335,679	1,555,347	3,256,882	164,512	1,102,613
July	4,092,615	4,187,430	2,621,279	51,158	417,352	382,604	4,982,888	439,703	269,148	1,509,080	3,083,854	150,064	1,055,705
August	5,000,222	3,629,100	2,821,712	116,638	241,227	431,038	4,260,941	851,929	235,718	1,326,600	2,039,716	174,689	971,880
September	4,944,006	2,955,120	2,460,708	149,530	170,552	348,230	2,893,131	1,080,723	199,113	1,000,580	1,272,240	126,570	901,060
October	4,056,185	2,225,880	2,165,814	289,944	466,193	456,645	1,905,389	1,147,781	333,432	919,181	829,827	141,736	809,496
November	3,530,565	1,368,630	2,003,803	324,174	940,682	811,161	716,583	1,075,045	399,001	905,288	684,736	194,808	866,713
December	2,573,028	763,680	1,677,239	342,252	1,570,413	946,733	2,353,211	856,340	518,289	1,391,955	1,874,905	331,154	1,927,724

TABLE 13. — *Fish Placed in Cold Storage from December 15, 1939, to December 15, 1940*

	Bluefish (lbs.)	Butterfish (lbs.)	Catfish (lbs.)	Cod, Hake, Pollock and Haddock (lbs.)	Cod Fillets (lbs.)	Flounders (lbs.)	Haddock Fillets (lbs.)	Halibut (lbs.)	Herring (lbs.)	Mackerel (lbs.)	Pollock Fillets (lbs.)
January	8,527	8,499	4,826	51,242	195,137	82,380	696,428	40,225	180,986	37,954	1,632,471
February	3,152	3,225	4,070	81,894	93,603	45,205	1,128,003	135,235	101,045	99,578	108,857
March	1,880	4,672	1,489	84,804	354,556	18,760	788,265	107,573	112,464	80,665	47,380
April	2,520	9,986	2,825	40,830	89,500	46,663	629,696	22,919	74,010	56,122	48,170
May	371	2,220	9,548	90,491	288,985	101,614	1,839,315	15,489	42,335	263,222	68,109
June	488	50,178	16,203	132,520	302,711	127,456	1,292,008	28,753	920,665	1,161,181	375,286
July	300	61,503	5,805	217,507	623,720	67,965	2,587,030	17,623	166,559	4,227,301	142,870
August	150	30,800	3,850	224,649	905,362	106,210	3,633,755	41,849	41,110	1,576,938	225,329
September	371	89,786	1,640	245,679	635,872	106,560	2,796,774	17,113	139,178	1,608,761	368,276
October	381	11,235	862	172,383	585,007	183,635	1,903,040	78,344	162,615	715,779	593,365
November	1,225	2,363	2,447	315,495	1,164,875	214,191	851,530	194,580	213,514	1,164,991	2,164,318
December	7,590	1,492	460	139,877	550,664	79,930	354,175	111,533	86,317	106,962	3,967,387

	Redfish Fillets (lbs.)	Fall and Silver Salmon (lbs.)	Salmon, all Others (lbs.)	Scup (lbs.)	Shad (lbs.)	Shellfish (lbs.)	Smelts, Eulachon, etc. (lbs.)	Squid (lbs.)	Swordfish (lbs.)	Whiting (lbs.)	Miscellaneous Frozen Fish (lbs.)
January	1,241,497	31,467	5,400	–	72	119,414	69,736	–	27,467	27,380	184,674
February	1,407,000	106,224	12,100	–	200	42,712	165,384	15,196	180,288	250,920	165,136
March	1,133,958	40,532	28,215	–	–	42,550	483,793	–	187,642	12,405	106,691
April	534,545	47,470	26,536	–	181	27,391	59,827	10,629	57,144	–	111,436
May	557,794	6,815	1,503	2,826	2,281	176,496	42,984	15,905	67,908	61,955	107,932
June	2,798,465	2,635	28,445	30,090	15,009	432,598	63,138	300,469	26,299	2,729,627	89,273
July	1,808,995	10,234	11,432	6,721	4,333	242,336	100	107,795	111,396	5,155,065	194,303
August	2,743,245	705	5,753	6,859	57,875	375,643	8,710	413,062	327,530	5,271,956	568,883
September	2,150,420	13,648	1,451	1,600	20,424	289,150	3,710	319,002	392,922	4,561,482	688,058
October	2,074,339	65,965	35,107	178	180	368,461	20,424	181,287	193,403	1,945,781	509,684
November	1,592,408	64,634	6,737	78	510	392,516	29,807	64,600	89,819	766,441	406,193
December	1,383,757	68,850	6,130	–	8,148	210,269	42,230	22,184	15,655	191,913	247,927

TABLE 14. — *Fish on Hand in Cold Storage on the Fifteenth Day of the Month, from January 15, 1940, through December 15, 1940*

	Bluefish (lbs.)	Butterfish (lbs.)	Catfish (lbs.)	Cod, Hake, Pollock and Haddock (lbs.)	Cod Fillets (lbs.)	Flounders (lbs.)	Haddock Fillets (lbs.)	Halibut (lbs.)	Herring (lbs.)	Mackerel (lbs.)	Pollock Fillets (lbs.)
January	25,450	251,794	12,419	363,198	1,307,814	220,953	2,131,790	86,692	392,024	4,313,885	5,108,599
February	23,601	181,113	7,265	363,200	572,436	196,444	1,617,934	116,522	282,105	3,435,966	4,184,704
March	19,889	103,272	2,547	128,261	170,871	131,623	451,397	56,236	271,464	2,456,690	2,676,240
April	14,690	77,162	4,027	71,306	47,570	95,282	207,721	12,397	211,030	1,474,894	1,642,853
May	11,345	46,775	9,434	109,656	194,650	114,893	930,815	21,261	183,773	660,756	672,182
June	8,617	79,093	14,757	146,638	283,861	169,349	1,177,528	25,794	848,148	1,149,935	495,868
July	5,969	128,812	16,399	291,732	677,307	184,350	2,652,255	34,593	766,315	5,212,790	280,073
August	827	143,828	10,892	444,196	1,012,514	233,264	4,452,241	52,593	667,395	6,158,427	201,098
September	458	214,140	1,877	521,371	832,732	264,441	4,591,900	55,730	719,265	7,040,449	208,029
October	689	213,028	1,299	541,595	801,144	387,250	4,750,795	116,254	762,330	6,997,584	249,731
November	1,262	168,781	2,501	704,300	1,603,951	525,562	3,962,123	179,704	899,189	7,068,953	1,912,857
December	8,458	124,905	1,973	672,731	1,835,395	515,429	2,963,925	154,605	867,280	5,818,157	4,808,282

	Redfish Fillets (lbs.)	Fall and Silver Salmon (lbs.)	Salmon, all Others (lbs.)	Scup (lbs.)	Shad (lbs.)	Shellfish (lbs.)	Smelts, Eulachon, etc. (lbs.)	Squid (lbs.)	Swordfish (lbs.)	Whiting (lbs.)	Miscel-laneous Frozen Fish (lbs.)
January	2,717,485	44,012	16,632	34,085	20,440	729,304	60,420	1,103,927	60,904	5,059,525	851,368
February	2,482,374	118,020	18,163	28,183	16,951	341,665	166,143	905,408	155,587	3,830,333	709,515
March	1,873,885	94,582	28,054	19,102	10,046	149,976	587,156	667,777	163,791	2,643,334	568,866
April	1,022,765	100,982	36,075	13,910	6,327	82,311	536,761	435,616	87,343	1,772,724	436,114
May	338,872	68,893	27,472	14,380	4,568	173,910	526,361	183,405	52,798	830,935	428,138
June	1,386,433	43,060	36,560	38,503	16,792	480,235	558,791	407,448	21,658	2,030,798	413,176
July	1,741,913	30,559	38,206	45,224	19,464	563,186	533,634	484,207	70,700	5,577,547	476,114
August	2,301,235	17,685	31,869	51,929	43,360	770,330	514,952	815,940	357,376	7,905,569	912,966
September	1,587,868	21,975	27,521	53,404	61,882	815,674	478,207	899,251	732,994	8,741,165	1,276,995
October	1,070,223	75,100	60,959	52,893	55,375	1,010,192	411,297	845,505	689,762	8,354,384	1,434,831
November	925,441	77,583	53,493	43,687	47,599	1,118,670	360,919	716,831	413,884	7,654,481	1,525,544
December	890,008	96,693	45,271	30,445	46,619	1,159,775	304,634	578,538	259,484	6,216,485	1,514,444

Summary of Tables 15 and 16

Requests for extension of time granted		220
Eggs	19	
Poultry	19	
Meat and Meat Products	84	
Fish	98	
Articles ordered removed from storage (no requests made)		30
Meat and Meat Products	1	
Game	4	
Fish	25	

Table 15.—*Requests for Extension of Time Granted on Goods in Cold Storage, from December 1, 1939, to December 1, 1940*

(Reason for such extension being that goods were in proper condition for further storage.)

Article	Weight (Pounds)	Placed in Storage	Extension Granted to	Name
Eggs	35,400	†May 1, 1937	Feb. 17, 1940	Borden Co., The
Eggs	5,280	†Apr. 3, 1938	Feb. 2, 1940	Standard Brands, Inc.
Sugar Yolks	3,160	May 25, 1939	Aug. 25, 1940	Armour & Co.
Sugar Yolks	550	May 1, 1939	Aug. 1, 1940	Standard Brands, Inc.
Voltex	2,000	†Apr. 18, 1938	Feb. 2, 1940	Standard Brands, Inc.
Voltex	1,730	May 1, 1939	Aug. 1, 1940	Standard Brands, Inc.
Voltex	2,000	May 1, 1939	*Nov. 1, 1940	Standard Brands, Inc.
Egg Whites	6,000	Jan. 21, 1939	July 21, 1940	Armour & Co.
Egg Whites	6,570	Mar. 11, 1939	May 11, 1940	Ovson Egg Co.
Egg Whites	555	Apr. 15, 1939	June 15, 1940	Saunders & DeWilde, Inc.
Egg Whites (2 lots)	5,070	May 1, 1939	Aug. 1, 1940	Standard Brands, Inc.
Egg Whites	9,900	Dec. 21, 1938	Mar. 21, 1940	Wilson & Co.
Whole Eggs	1,110	Jan. 23, 1939	July 23, 1940	Armour & Co.
Whole Eggs	500	Apr. 26, 1939	July 26, 1940	Armour & Co.
Whole Eggs	690	May 25, 1939	Aug. 25, 1940	Armour & Co.
Whole Eggs	210	June 27, 1939	Sept. 27, 1940	Armour & Co.
Whole Eggs	3,000	May 1, 1939	Aug. 1, 1940	Standard Brands, Inc.
Egg Yolks	780	Apr. 3, 1939	June 15, 1940	Saunders & DeWilde, Inc.
Chickens	3,935	Oct. 16, 1939	Dec. 16, 1940	Armour & Co.
Chickens	3,245	Oct. 20, 1939	Dec. 15, 1940	Forbes & Wallace, Inc.
Chickens	2,384	Oct. 27, 1939	Dec. 15, 1940	Forbes & Wallace, Inc.
Fricassee Fowl	2,994	Sept. 25, 1939	Mar. 31, 1941	Frosted Foods Sales Corp
Fricassee Fowl	3,400	Oct. 6, 1939	Mar. 30, 1941	Frosted Foods Sales Corp.
Fricassee Fowl	4,691	Oct. 13, 1939	Mar. 31, 1941	Frosted Foods Sales Corp.
Fricassee Fowl	1,080	Oct. 24, 1939	Mar. 31, 1941	Frosted Foods Sales Corp.
Roasters	3,832	Oct. 20, 1939	Mar. 30, 1941	Frosted Foods Sales Corp.
Roasters	334	Oct. 5, 1939	Mar. 31, 1941	Frosted Foods Sales Corp.
Roasters	4,067	†Nov. 23, 1938	Aug. 1, 1940	Frosted Foods Sales Corp.
Turkeys (3 lots)	7,645	Sept. 27, 1939	Jan. 27, 1941	Berman & Co., Inc.
Turkeys	1,330	Oct. 6, 1939	Mar. 24, 1941	Berman & Co., Inc.
Turkeys	3,734	Oct. 24, 1939	Mar. 24, 1941	Berman & Co., Inc.
Turkeys	3,918	Oct. 26, 1939	Mar. 24, 1941	Berman & Co., Inc.
Turkeys (2 lots)	1,773	Nov. 3, 1939	Apr. 3, 1941	Berman & Co., Inc.
Turkeys	3,460	Nov. 29, 1939	Apr. 3, 1941	Berman & Co., Inc.
Beef (4 lots)	1,900	Dec. 1, 1938	Oct. 1, 1940	Collins, Daniel J.
Beef (4 lots)	1,500	Mar. 1, 1939	Oct. 1, 1940	Collins, Daniel J.
Beef	200	‡	Dec. 1, 1940	Holly, Norman J.
Beef Kidneys	397½	July 13, 1939	Dec. 31, 1940	Mades Co., Inc., M. M.
Beef Kidneys	450	July 14, 1939	Dec. 31, 1940	Mades Co., Inc., M. M.
Beef Kidneys	1,244	Aug. 15, 1939	Dec. 31, 1940	Mades Co., Inc., M. M.
Beef Kidneys	1,357	Oct. 21, 1939	Dec. 31, 1940	Mades Co., Inc., M. M.
Beef Kidneys	432	Dec. 2, 1939	Dec. 31, 1940	Mades Co., Inc., M. M.
Beef Kidneys	678	Dec. 22, 1939	Dec. 31, 1940	Mades Co., Inc., M. M.
Beef Kidneys	367	Dec. 23, 1939	Dec. 31, 1940	Mades Co., Inc., M. M.
Calves Liver	1,500	June 12, 1939	Nov. 1, 1940	Frosted Foods Sales Corp.
Calves Liver	662	†Sept. 5, 1938	Mar. 31, 1941	Frosted Foods Sales Corp.
Calves Liver	1,100	†Nov. 20, 1940	Apr. 1, 1941	Frosted Foods Sales Corp.
Beef Loins	2,557	May 3, 1939	Sept. 15, 1940	Mades Co., Inc., M. M.
Beef Loins	3,377	May 15, 1939	Sept. 15, 1940	Mades Co., Inc., M. M.
Beef Loins	2,000	Mar. 14, 1939	Sept. 15, 1940	South Market Beef Co.
Chuck Roast	1,052	May 3, 1939	Dec. 1, 1940	Frosted Foods Sales Corp.
Chuck Roast	1,958	†May 26, 1939	Mar. 31, 1941	Frosted Foods Sales Corp.
Chuck Roast	662	Oct. 17, 1939	Mar. 31, 1941	Frosted Foods Sales Corp.
Rib Roast	366	†Apr. 5, 1939	Dec. 1, 1940	Frosted Foods Sales Corp.
Rib Roast	1,029	†May 16, 1939	Dec. 1, 1940	Frosted Foods Sales Corp.
Rib Roast	1,987	Oct. 17, 1939	Mar. 31, 1941	Frosted Foods Sales Corp.
Rump Steak	1,900	†Apr. 27, 1939	Dec. 1, 1940	Frosted Foods Sales Corp.
Rump Steak	1,837	†May 18, 1939	Dec. 1, 1940	Frosted Foods Sales Corp.
Lamb	3,000	†Apr. 1, 1940	Dec. 31, 1940	Frosted Foods Sales Corp.
Rib Lamb Chops	2,350	Jan. 24, 1939	June 1, 1940	Frosted Foods Sales Corp.
Lamb Legs	1,605	†Aug. 26, 1938	June 1, 1940	Frosted Foods Sales Corp.
Lamb Legs	1,914	†Sept. 19, 1938	Nov. 1, 1940	Frosted Foods Sales Corp.

*The extension of time granted on this lot was amended before the expiration of the time to which extended. The length of time given includes the total amended period, and the weights given are the initial weights upon which extensions were asked.

†Previously frozen.

‡Frozen and undated.

TABLE 15.—*Requests for Extension of Time Granted on Goods in Cold Storage, from December 1, 1939, to December 1, 1940—Continued*

Article	Weight (Pounds)	Placed in Storage	Extension Granted to	Name
Lamb Legs . . .	536	†Oct. 5, 1938	Mar. 31, 1941	Frosted Foods Sales Corp.
Lamb Legs . . .	1,395	Dec. 5, 1938	*June 1, 1940	Frosted Foods Sales Corp.
Lamb Legs . . .	2,135	Sept. 27, 1939	Mar. 31, 1941	Frosted Foods Sales Corp.
Lamb Legs . . .	3,664	Oct. 14, 1939	Nov. 1, 1940	Frosted Foods Sales Corp.
Lamb Legs . . .	981	†Nov. 20, 1940	Apr. 1, 1941	Frosted Foods Sales Corp.
Pork Bellies (2 lots) .	7,996	Mar. 18, 1939	July 1, 1940	Maloney Packing Co.
Pork Bellies (3 lots) .	9,719	Apr. 1, 1939	Aug. 8, 1940	Maloney Packing Co.
Pork Bellies (3 lots) .	12,219	Apr. 7, 1939	Aug. 8, 1940	Maloney Packing Co.
Pork Bellies (4 lots) .	10,994	May 2, 1939	Aug. 2, 1940	Maloney Packing Co.
Pork Bellies (2 lots) .	1,908	June 24, 1939	Sept. 24, 1940	Maloney Packing Co.
Pork Bellies (4 lots) .	3,790	June 29, 1939	Sept. 24, 1940	Maloney Packing Co.
Pork Bellies (2 lots) .	1,938	July 13, 1939	Oct. 13, 1940	Maloney Packing Co.
Pork Bellies . .	658	July 14, 1939	Oct. 13, 1940	Maloney Packing Co.
Pork Bellies . .	636	July 15, 1939	Oct. 13, 1940	Maloney Packing Co.
Pork Bellies (2 lots) .	3,242	July 19, 1939	Oct. 13, 1940	Maloney Packing Co.
Pork Bellies (2 lots) .	2,267	July 21, 1939	Oct. 13, 1940	Maloney Packing Co.
Pork Bellies (4 lots) .	3,097	July 22, 1939	Oct. 13, 1940	Maloney Packing Co.
Pork Chops . .	934	†Nov. 20, 1940	Apr. 1, 1941	Frosted Foods Sales Corp.
Pork Loins . . .	705	Nov. 14, 1938	*Apr. 1, 1941	Frosted Foods Sales Corp.
Pork Loin Roast . .	1,981	†Dec. 16, 1938	Dec. 1, 1940	Frosted Foods Sales Corp.
Sausage Links . .	1,395	Nov. 14, 1938	*Sept. 30, 1940	Frosted Foods Sales Corp.
Rabbits . . .	1,386	Dec. 20, 1938	Mar. 20, 1940	Alfonse, Frank
Dog Meat . . .	400	Feb. 4, 1939	July 1, 1940	Collins, Daniel J.
Dog Meat . . .	500	Feb. 10, 1939	July 1, 1940	Collins, Daniel J.
Dog Meat . . .	500	Feb. 21, 1939	July 1, 1940	Collins, Daniel J.
Dog Meat . . .	400	Feb. 23, 1939	July 1, 1940	Collins, Daniel J.
Dog Meat . . .	400	Mar. 14, 1939	July 1, 1940	Collins, Daniel J.
Dog Meat . . .	100	Oct. 25, 1938	Jan. 1, 1941	Treat, Lester A.
Dog Meat . . .	500	Mar. 1, 1939	Jan. 1, 1941	Treat, Lester A.
Dog Meat . . .	500	Apr. 3, 1939	Jan. 1, 1941	Treat, Lester A.
Dog Meat . . .	600	May 8, 1939	Jan. 1, 1941	Treat, Lester A.
Horsemeat . . .	400	Nov. 1, 1938	July 1, 1940	Perry, W. T.
Fish	60	Feb. 25, 1939	Sept. 1, 1940	Butler Flour Co., Inc.
Fish	60	Mar. 18, 1939	Sept. 1, 1940	Butler Flour Co., Inc.
Butterfish . . .	150	July 6, 1939	Dec. 31, 1940	Warren Fitch Co.
Butterfish . . .	445	July 12, 1939	Dec. 31, 1940	Warren Fitch Co.
Butterfish . . .	600	July 24, 1939	Dec. 31, 1940	Warren Fitch Co.
Butterfish (2 lots) .	5,850	July 26, 1939	Feb. 5, 1941	General Seafoods Corp.
Butterfish . . .	235	Aug. 5, 1939	Feb. 5, 1941	General Seafoods Corp.
Butterfish . . .	750	Aug. 10, 1939	Feb. 5, 1941	General Seafoods Corp.
Butterfish . . .	625	Aug. 18, 1939	Feb. 5, 1941	General Seafoods Corp.
Smoked Cod Cutlets(3 lots)	1,730	May, June, 1939	Aug. 1, 1940	Gorton-Pew Fish. Co.,Ltd.
Eels	150	Nov. 17, 1939	Dec. 20, 1940	Russo & Sons Co.
Eels	2,000	Nov. 28, 1939	Dec. 23, 1940	Nagle Co., John
Flounder Sole Fils. .	3,050	Oct. 10, 1939	Jan. 10, 1941	Forty-Fathom Fish, Inc.
Flounder Sole Fils. .	2,000	Oct. 24, 1939	Jan. 24, 1941	Forty-Fathom Fish, Inc.
Flounder Sole Fils. .	2,310	Oct. 25, 1939	Jan. 10, 1941	Forty-Fathom Fish, Inc.
Flounder Sole Fils. .	3,540	Oct. 25, 1939	Jan. 24, 1941	Forty-Fathom Fish, Inc.
Flounder Sole Fils. .	930	Oct. 30, 1939	Jan. 10, 1941	Forty-Fathom Fish, Inc.
Flounder Sole Fils. .	860	Dec. 6, 1939	Mar. 15, 1941	Forty-Fathom Fish, Inc.
Flounder Sole Fils. .	100	Dec. 8, 1939	Mar. 15, 1941	Forty-Fathom Fish, Inc.
Flounder Sole Fils. .	180	Dec. 14, 1939	Mar. 15, 1941	Forty-Fathom Fish, Inc.
Flounder Sole Fils. .	2,310	Dec. 20, 1939	Mar. 15, 1941	Forty-Fathom Fish, Inc.
Flounder Sole Fils. .	920	Dec. 21 ,1939	Mar. 15, 1941	Forty-Fathom Fish, Inc.
Flounder Sole Fils. .	180	Dec. 28, 1939	Mar. 15, 1941	Forty-Fathom Fish, Inc.
Dressed Haddock . .	614	Jan. 3, 1939	Oct. 1, 1940	Batchelder & Snyder
Halibut . . .	360	Sept. 21, 1939	Mar. 20, 1941	Goodspeed Co., Inc., L. B.
Lobster Meat . .	105	June 27, 1939	Sept. 30, 1940	Consolidated Lobster Co.
Lobster Meat . .	850	July 8, 1939	Sept. 30, 1940	Consolidated Lobster Co.
Lobster Meat . .	700	July 18, 1939	Sept. 30, 1940	Consolidated Lobster Co.
Lobster Meat . .	450	July 21, 1939	Sept. 30, 1940	Consolidated Lobster Co.
Lobster Meat . .	145	Sept. 1, 1939	Mar. 1, 1941	Consolidated Lobster Co.
Lobster Meat . .	300	Sept. 6, 1939	Mar. 1, 1941	Consolidated Lobster Co.
Lobster Meat . .	352	Dec. 9, 1938	Mar. 9, 1940	Russo & Sons, A.
Mackerel . . .	1,810	Aug. 24, 1939	Feb. 5, 1941	General Seafoods Corp.
Mackerel . . .	1,810	Aug. 24, 1939	Feb. 28, 1941	General Seafoods Corp.
Mackerel . . .	10,965	Nov. 22, 1939	Mar. 31, 1941	General Seafoods Corp.
Mackerel . . .	632	July 2, 1939	Jan. 1, 1941	Quincy Mkt. C. S. & W. Co.
Blink Mackerel . .	842	July 25, 1939	Jan. 25, 1941	Smith, D. D.
Tinker Mackerel . .	1,600	July 26, 1939	Jan. 31, 1941	Wellworth Market, Inc.
Oysters (2 lots) . .	2,360	Dec. 1, 1938	*Aug. 1, 1940	Gorton-Pew Fish. Co., Ltd.
Polpi	280	Nov. 9, 1939	Dec. 31, 1940	Busalacchi, T. & J.
Polpi (2 lots) . .	4,300	‡Feb. 24, 1940	Feb. 28, 1941	Mantia & Sons Co., John
Salmon . . .	451	Sept. 29, 1939	Dec. 29, 1940	Harding Co., F. E.
Salmon . . .	2,300	Sept. 23, 1940	Dec. 23, 1940	N. E. Fish Co.
Dressed Silver Salmon .	3,700	Oct. 4, 1939	Apr. 4, 1941	O'Hara & Sons, Inc., F. J.
Sardines (2 lots) . .	3,156	Oct. 10, 1939	Dec. 31, 1940	Busalacchi Bros., Inc.
Sardines . . .	2,042	Nov. 4, 1939	Dec. 30, 1940	Corso & Gambino Co., Inc.

*The extension of time granted on this lot was amended before the expiration of the time to which extended. The length of time given includes the total amended period, and the weights given are the initial weights upon which extensions were asked.

†Previously frozen.

‡Frozen and undated.

Table 15.—*Requests for Extension of Time Granted on Goods in Cold Storage, from December 1, 1939, to December 1, 1940—Concluded*

Article	Weight (Pounds)	Placed in Storage	Extension Granted to	Name
Sardines	1,200	Nov. 13, 1939	Feb. 28, 1941	Mantia Fish Corp.
Sardines	240	Nov. 17, 1939	Dec. 31, 1940	Mantia Fish Corp.
Sardines	3,000	Nov. 4, 1939	Dec. 20, 1940	Russo & Sons Co.
Cape Scallops	36	Nov. 16, 1939	Dec. 31, 1940	Hanley Oil Co.
Cape Scallops	351	Nov. 18, 1939	May 18, 1940	Hanley Oil Co.
Scups	2,060	May 18, 1939	Nov. 30, 1940	Corso & Gambino Co., Inc.
Scups	1,300	May 12, 1939	*Mar. 12, 1941	Russo & Sons Co.
Scups	2,200	June 14, 1939	*Mar. 12, 1941	Russo & Sons Co.
Scups	1,200	June 16, 1939	*Mar. 12, 1941	Russo & Sons Co.
Sepia	610	Nov. 15, 1939	Dec. 20, 1940	Russo & Sons Co.
Cooked Shrimp	1,880	Jan. 3, 1939	Oct. 1, 1940	Batchelder & Snyder Co.
Lemon Sole	310	May 19, 1939	Nov. 19, 1940	Warren Fitch Co.
Squid	2,080	May 25, 1939	Dec. 1, 1940	Busalacchi Bros., Inc.
Squid	1,800	May 29, 1939	Dec. 1, 1940	Busalacchi Bros., Inc.
Squid	4,570	May 31, 1939	Dec. 1, 1940	Busalacchi Bros., Inc.
Squid (2 lots)	7,625	June 5, 1939	Dec. 1, 1940	Busalacchi Bros., Inc.
Squid	5,400	June 12, 1939	Dec. 1, 1940	Busalacchi Bros., Inc.
Squid	2,525	June 13, 1939	Dec. 1, 1940	Busalacchi Bros., Inc.
Squid	3,800	June 14, 1939	Dec. 1, 1940	Busalacchi Bros., Inc.
Squid	1,600	June 19, 1939	Dec. 1, 1940	Busalacchi Bros., Inc.
Squid	3,000	June 20, 1939	Dec. 1, 1940	Busalacchi Bros., Inc.
Squid	3,400	May 29, 1939	*Dec. 16, 1940	Busalacchi, Inc., T. & J.
Squid	2,500	June 1, 1939	Dec. 31, 1940	Busalacchi, Inc., T. & J.
Squid	3,570	June 3, 1939	Dec. 31, 1940	Busalacchi, Inc., T. & J.
Squid (2 lots)	8,600	May 25, 1939	Nov. 30, 1940	Corso & Gambino Co., Inc.
Squid (2 lots)	4,000	May 26, 1939	Nov. 30, 1940	Corso & Gambino Co., Inc.
Squid (2 lots)	8,075	May 31, 1939	Nov. 30, 1940	Corso & Gambino Co., Inc.
Squid (2 lots)	7,700	June 2, 1939	Dec. 16, 1940	Corso & Gambino Co., Inc.
Squid	4,980	June 12, 1939	Dec. 19, 1940	Corso & Gambino Co., Inc.
Squid	5,310	June 16, 1939	Dec. 16, 1940	Corso & Gambino Co., Inc.
Squid	3,855	June 19, 1939	Dec. 19, 1940	Corso & Gambino Co., Inc.
Squid	645	July 3, 1939	Dec. 19, 1940	Corso & Gambino Co., Inc.
Squid	4,674	May 14, 1939	Dec. 15, 1940	Mantia & Sons, J.
Squid	8,215	May 15, 1939	Dec. 15, 1940	Mantia & Sons, J.
Squid	1,215	May 27, 1939	Dec. 15, 1940	Mantia & Sons, J.
Squid	3,360	May 29, 1939	Dec. 15, 1940	Mantia & Sons, J.
Squid (2 lots)	3,885	May 31, 1939	Dec. 15, 1940	Mantia & Sons, J.
Squid	1,200	June 1, 1939	Dec. 31, 1940	Mantia & Sons, J.
Squid	360	July 5, 1939	Jan. 1, 1941	Quincy Mkt. C. S. & W. Co.
Squid	2,500	May 27, 1939	*Oct. 27, 1940	Tocco, Joseph

*The extension of time granted on this lot was amended before the expiration of the time to which extended. The length of time given includes the total amended period, and the weights given are the initial weights upon which extensions were asked.

Table 16.—*Articles Which Had Been in Cold Storage Longer than Twelve Months, and on Which No Requests for Extensions Had Been Made, Ordered Removed, from December 1, 1939, to December 1, 1940*

Article	Weight (Pounds)	Placed in Storage	Name
Briskets	224	June 20, 1939	Grant Co., W. T.
Elk Meat	75	Nov. 17, 1938	Bartula, Peter
Venison	33	Dec. 15, 1938	Clark, J.
Venison	–	Dec. 16, 1938	Gould, Joseph E.
Venison	24	Nov. 22, 1938	LaRose, Ralph K.
Butterfish	225	Aug. 23, 1939	Gorton, J. B.
Clams	64	May 18, 1939	Gloucester Shellfish Co.
Clams	56	May 27, 1939	Gloucester Shellfish Co.
Flounder Fillets	30	Oct. 14, 1939	Best Fish Co.
Haddock Fillets	210	Oct. 31, 1938	Gilman, F. M.
Haddock Fillets	2,190	Dec. 10, 1938	Redding, C. F.
Mackerel	315	Oct. 13, 1939	Gloucester Fresh Fish Co.
Perch (2 lots)	132	July 28, 1939	Atlantic Quick Freeze Co.
Sardine Herring	250	Nov. 9, 1938	Busalacchi Bros.
Scup	700	June 29, 1939	Seaconnet River Fishing Co.
Buck Shad	235	Apr. 29, 1939	Goodspeed, Inc., L. B.
Smelts	250	Apr. 18, 1939	Alexander's Market
Smelts (2 lots)	720	Oct. 22, 1939	Foley Co., M. F.
Sole	66	Oct. 13, 1938	Atlantic Quick Freeze Co.
Sole	1,200	Oct. 16, 1939	Atlantic Quick Freeze Co.
Sole	810	Oct. 23, 1939	Atlantic Quick Freeze Co.
Sole (2 lots)	294	Nov. 1, 1939	Atlantic Quick Freeze Co.
Swordfish (3 lots)	810	Aug. 16, 1939	Atlantic Quick Freeze Co.
Swordfish	90	Sept. 2, 1939	Atlantic Quick Freeze Co.
Whiting, Dressed	810	July 7, 1939	Atlantic Quick Freeze Co.

Table 17.—*Confiscations*

In Stores, Markets, Etc.

Fowl	50 lbs.	Decomposed
Turkey	15 lbs.	Decomposed
Beef Trimmings	30 lbs.	Decomposed
Calves' Heads	11½ lbs.	Decomposed
Calves' Liver	4 lbs.	Decomposed
Hamburg (3 lots)	56 lbs.	Decomposed
Meat Scraps and Hamburg	12 lbs.	Decomposed
Rib Roast	21 lbs.	Decomposed
Lamb (3 lots)	26¼ lbs.	Decomposed
Lamb Forequarter	10½ lbs.	Decomposed
Bacon (2 lots)	60 lbs.	Decomposed
Bacon	4¾ lbs.	Putrid
Bologna	25 lbs.	Decomposed
Frankforts (2 lots)	32 lbs.	Decomposed
Ham (3 lots)	29¾ lbs.	Decomposed
Italian Ham	7¾ lbs.	Decomposed
Pressed Ham	4¼ lbs.	Decomposed
Scotch Ham	2 lbs.	Decomposed
Pigs' Ears	15 lbs.	Decomposed
Pickled Pigs' Feet	2½ gals.	Decomposed
Pork	3½ lbs.	Decomposed
Suet Pork	30 lbs.	Decomposed
Salami	75 lbs.	Decomposed
Sausage (2 lots)	8 lbs.	Decomposed
Sausage, Homemade	5 lbs.	Unfit for food
Smoked Shoulder	4½ lbs.	Decomposed
Cold Cuts	25 lbs.	Decomposed
Salmon	25 cans	Cans bulged
Miscellaneous		
Beans	3 cans	Cans bulged
Baked Beans (2 lots)	16 cans	Cans bulged
Black Beans	10 lbs.	Wormy
Kidney Beans	2 lbs.	Wormy
Cantaloupes	25	Moldy
Celery	7 bunches	Decomposed
Cider	1 gal.	Decomposed
Cheese	20 lbs.	Decomposed
Greek Cheese	10 lbs.	Decomposed
Cocoa (3 lots)	74 pkgs.	Wormy
Cocoa	9 cans	Cans bulged
Corn Starch	19 lbs.	Wormy
Currants	11 pkgs.	Wormy and moldy
Dessert	58 pkgs.	Wormy
Cake Flour	1 pkg.	Wormy
Pancake Flour	21 pkgs.	Wormy
Ice Cream Powder	4 pkgs.	Wormy
Lime Juice	6 bottles	Discolored; sediment
Malt Syrup	1 can	Can bulged
Evaporated Milk (2 lots)	27 cans	Cans bulged
Molasses	6 cans	Cans bulged
Egg Noodles (3 lots)	24 pkgs.	Wormy
Split Peas	6 pkgs.	Wormy
Pears	3 cans	Cans bulged
Pimento	7 pkgs.	Wormy
Chocolate Pudding	7 pkgs.	Wormy
Rice	19 pkgs.	Wormy
Soup	1 can	Can bulged
Soup Mixtures	5 pkgs.	Wormy
Spaghetti	1 pkg.	Wormy
Squash	1 can	Can bulged
Syrup	31 cans	Discolored; rusty tops
Vanilla	1 pkg.	Wormy

In Warehouses

Chicken (2 lots)	290 lbs.	Decomposed
Fowl	866 lbs.	Decomposed
Poultry	40 lbs.	Decomposed
Turkeys (2 lots)	3,102 lbs.	Decomposed
Turkeys	245 lbs.	Moldy, decomposed
Beef Liver	30 lbs.	Decomposed
Bacon	28 lbs.	Moldy
Link Pork Sausage	30 lbs.	Decomposed
Pork Trimmings	1,385 lbs.	Decomposed
Veal Steaks	25 lbs.	Decomposed
Wild Boar	–	Unclaimed; in storage 5 yrs.
Antarctic Seal	–	Unclaimed; in storage 5 yrs.
Butterfish (2 lots)	650 lbs.	Decomposed
Skinned Fillets	690 lbs.	Decomposed
Haddock Fillets	275 lbs.	Decomposed
Smoked Mackerel	100 lbs.	Decomposed
Ocean Perch	200 lbs.	Decomposed
Eastern Salmon	450 lbs.	Decomposed
Scallops	940 lbs.	Decomposed
Scrod	90 lbs.	Decomposed
Shrimp (7 lots)	6,203 lbs.	Decomposed
Grey Sole	280 lbs.	Decomposed
Squid (3 lots)	9,120 lbs.	Decomposed

Table 17.—*Confiscations*—Concluded

In Factories

Beef Trimmings	300 lbs.	Decomposed
Corned Beef	400 lbs.	Decomposed
Pork Sausage Meat	900 lbs.	Decomposed

In Restaurants

Boiled Lobsters	–	Decomposed
Swordfish	2 lbs.	Decomposed

Total Confiscations:

27,269¾ lbs.
123 cans
239 pkgs.
3½ gals.
6 bottles
36 miscellaneous

Table 18.—*Slaughtering Report from December 1, 1939, through November 30, 1940*

Total Number of Carcasses Inspected . . . 173,797

Cattle	28,208	Hogs	55,327
Calves	87,870	Sheep	2,392

Total Number of Carcasses Condemned . . . 2,266

Cattle	122	Hogs	396
Calves	1,742	Sheep	6

Reasons for Confiscation	Cattle	Calves	Hogs	Sheep	Totals
Immaturity	–	1,567	–	–	1,567
Cholera	–	–	266	–	266
Tuberculosis	13	3	27	–	43
Pneumonia	15	4	13	–	32
Emaciation	10	3	18	–	31
Peritonitis	15	2	10	–	27
Septicemia	19	4	6	–	29
Hemorrhagic septicemia	–	–	14	–	14
Died other than by slaughter	13	131	8	4	156
Icterus	–	1	6	1	8
Bruised	10	13	11	1	35
Mastitis	2	–	–	–	2
Gastritis	–	1	–	–	1
Anemia	1	1	–	–	2
Pyemia	–	–	1	–	1
Fever	1	–	1	–	2
Abscesses	4	1	8	–	13
Ascites	2	–	–	–	2
Metritis	1	–	–	–	1
Pleurisy	–	–	1	–	1
Tumor	6	–	–	–	6
Scours	–	4	1	–	5
Gangrene	1	–	–	–	1
Heat prostration	–	–	2	–	2
Paralysis	–	–	1	–	1
Fetus	–	5	–	–	5
Prolapsed uterus	2	–	–	–	2
Strangulation	–	2	–	–	2
Parturition	2	–	–	–	2
Enteritis	1	–	1	–	2
Parturient paresis	2	–	–	–	2
Traumatic pericarditis	2	–	–	–	2
Ruptured	–	–	1	–	1
Totals	122	1,742	396	6	2,266

REPORT OF THE DIVISION OF GENITOINFECTIOUS DISEASES

N. A. Nelson, M.D., *Director*

The Division of Genitoinfectious Diseases

The personnel of the Division consists of a director, two epidemiologists, three public health nursing supervisors and a stenographic and clerical staff of ten. Of these, one epidemiologist, the three nurses and four of the clerical force are paid from Federal funds. The work of the Division has increased to the point where a request has been made in the budget for 1942 for the position of assistant director.

The appropriation for the Division for 1940 was $267,250, plus a balance of $38,507 from the 1939 appropriation which by legislative action was made available for 1940. The total available from State appropriation, therefore, was $305,757. In addition, for the first seven months of the year there was available from Federal sources an appropriation at the rate of $120,000, and for the last five months of the year at the rate of $140,000 annually. This amounts to approximately $128,000 for the State fiscal year. A very considerable proportion of these funds was allocated to the Wassermann Laboratory and to professional education in genitoinfectious disease control. If the total cost of the Wassermann Laboratory is included (paid from both State and Federal sources), it appears that the Department had available for genitoinfectious disease control from all sources and for all purposes approximately $460,000, or at the rate of approximately eleven cents per capita.

Statistical Summaries

The trend of reporting during the past several years is indicated by the following figures:

Sources of Reports of Gonorrhea

Year	Total Cases	Physicians			Clinics		Institutions	
		Number	Cases	Per Cent	Cases	Per Cent	Cases	Per Cent
1936	6,097	958	3,268	53.6	2,280	37.4	549	9.0
1937	5,856	988	3,140	53.6	2,209	37.7	507	8.7
1938	4,938	883	2,272	46.0	2,266	45.9	400	8.1
1939	4,652	782	2,163	46.5	2,147	46.2	342	7.3
1940	4,014	786	1,815	45.2	1,894	47.2	305	7.6

Sources of Reports of Syphilis

Year	Total Cases	Number	Cases	Per Cent	Cases	Per Cent	Cases	Per Cent
1936	5,524	906	1,934	35.0	2,491	45.1	1,099	19.9
1937	6,207	961	2,103	33.9	2,788	44.9	1,316	21.2
1938	5,674	912	1,814	32.0	2,919	51.4	941	16.6
1939	4,888	839	1,576	32.3	2,528	51.7	784	16.0
1940	5,024	877	1,598	31.8	2,537	50.5	889	17.7

The decline in reports of gonorrhea, which began in 1932, has continued and since 1937 has been precipitous, but much greater in reports from physicians than in reports from clinics. Whether this is a true decline is difficult to say. The abrupt decline in reports from physicians coincides with the appearance of the sulfonamides. It is possible that physicians are using these drugs in any condition which might be gonorrhea without making the diagnosis, and thus without making a report. The decline in reports from clinics may be due to a decreasing tendency on the part of physicians to refer patients to clinics since treatment with the sulfonamides is much simpler than the older methods of treatment with which many physicians declined to be bothered.

The slight increase in the reports of syphilis is due primarily to an increase in reports from institutions, reports from physicians and clinics being approximately the same as for 1939. The reports of early syphilis increased slightly from 13.9 in 1939 to 15.0 in 1940. This is to be expected, however, since the figure for 1939 was abnormally low and considerably out of line with the rate of decline in previous years. Nevertheless the rate of 15 per 100,000 population is still very low and is less than the rate reported by the Scandinavian countries. Only 649 cases of early syphilis were reported during the year, as compared with 618 in 1939.

The number of communities represented in these reports of syphilis and gonorrhea was 280, as compared to 275 in 1939 and an average of 284 during the preceding five years.

There were 214 deaths from syphilis at a rate of 5.0 per 100,000 population as compared with a rate of 4.6 last year and an average rate of 4.3 for the preceding five years. If deaths from general paralysis of the insane and tabes dorsalis are included, as they should be, the total of deaths from syphilis was 340 at a rate of 7.9 per 100,000 population as compared with a rate of 7.4 for 1939 and an average rate of 7.8 for the preceding five years. There is, of course, no way of determining the actual death rate from syphilis because it is well known that many deaths from that disease are not so classified in the death certificates. The deaths from gonorrhea, so classified in the death certificates, are negligible.

Deaths from congenital syphilis numbered 11 in 1940. Only 14 cases of congenital syphilis in infants under one year of age were reported during the year. Several of these are duplicates, the actual number of different individuals being 8. Thus, since 27 cases were reported in 1939, this form of the disease appears to continue to disappear in this State.

Provision of Treatment

The twenty-five clinics designated as cooperating clinics were paid a total of approximately $216,000 during the fiscal year, or an increase of about $4,000 over the previous year. Patients and contacts made 223,877 visits, or nearly 25,000 visits less than during 1939. The cost per visit to the Commonwealth is approximately 99 cents, as compared with 85 cents in 1939. Patients paid approximately $31,200, so that the total cost of maintaining clinic service was about $245,000, or $1.13 per visit.

The increase in cost to the State is due partly to the fact that patients paid nearly $5,800 less this year than last year, or nearly $12,000 less than in 1938. The cost of transportation also increased from $6,500 to $7,800.

Only 49,000 visits were made for the treatment of gonorrhea as compared with 64,000 last year. Much of this decline is due to the fact that the sulfonamides cure patients so quickly that not nearly so many visits have to be made. Visits for treatment of syphilis declined from 184,000 to 174,000.

Through the use of Federal funds the clinics at the Boston Dispensary, the Massachusetts General Hospital and the Peter Bent Brigham Hospital have been completely remodeled and largely re-equipped and are attracting nation-wide attention as the best clinics in this field in the country, and perhaps in the world. These three clinics particularly, and some of the others, are now equipped for culture of the gonococcus which is so essential for the determination of cure when the sulfonamides are used. The laboratory at the Boston Dispensary is being used for the training of technicians from other laboratories in gonococcus culture.

The syphilis service at the Massachusetts General Hospital has now been transferred completely to the Department of Medicine and has been completely reorganized. The clinics are operated afternoons rather than during the morning.

The follow-up service in the clinics continues to be more and more effective as indicated by a continued decline in the number of cases which have to be reported to local boards of health. Only 1,046 cases were thus referred as compared to 1,650 last year and a peak of over 4,000 cases a few years ago before the service was well organized.

Some 38 hospitals sought reimbursement for the hospital care of patients with syphilis or gonorrhea, as compared to 40 last year. Hospital care was provided for 811 patients as compared to 784 last year, at a rate of $3.50 per day. Approximately 7,507 days of hospital care were given, as compared to 6,077 last year, at a total cost of $26,274.84, or approximately $5,000 more than in 1939.

Although the payment of private physicians was completely discontinued before the end of the year, a few patients to whose treatment the Department was committed have been provided treatment out of Federal funds. Some 26 physicians were reimbursed at the rate of $2.00 per visit for the treatment of 47 patients at a total cost of $1,271.26.

The twenty-five cooperating clinics admitted 1,858 new cases of gonorrhea and 2,338 new cases of syphilis, a decrease of 239 cases of gonorrhea and an increase of

39 cases of syphilis. These twenty-five clinics admitted 97 per cent of the new cases of gonorrhea and 90 per cent of the new cases of syphilis admitted to all of the thirty-one clinics in the State.

The seven epidemiologists who maintain a joint epidemiologic service for the six major Boston clinics followed 4,179 cases (3,789 in 1939) of which 3,262 (79%) were followed successfully. This compares with 81 per cent followed successfully last year. These epidemiologists made 9,761 visits (8,362 in 1939), or an average of 2.3 visits per case.

The experiment with extramural clinic service in North Adams as a function of the Pittsfield clinic seems to be working very satisfactorily. This North Adams physician has treated 28 patients who have made 820 visits at a total cost of $1,154.75, or a cost of $1.40 per visit.

Follow-up by Boards of Health

The 1,046 cases reported to the Department were referred to 97 boards of health. At the end of the year reports had been received from those boards in all but 3 per cent of the cases.

Follow-Up by Boards of Health

Year	Cases	Per Cent Found	Number of Communities	No Report from Board of Health: Per Cent of Cases	No Report from Board of Health: Communities
1936	3,663	51.3	157	5.0	39
1937	3,339	52.3	146	4.8	28
1938	2,020	57.4	131	7.5	34
1939	1,650	61.2	126	4.2	24
1940	1,046	66.7	97	3.0	14

Follow-Up Service for Private Physicians

Three nurses have been engaged throughout the year in the follow-up of cases for private physicians. These nurses visited 216 new physicians of whom 108 used the service. Thus since the service was inaugurated over three years ago when one nurse was employed, a total of 1,067 physicians have been contacted, of whom 407 have used the service. This year the nurses followed 362 patients and 85 contacts, a total of 447 persons. Of the patients followed, 259 had syphilis and 103 had gonorrhea. Of the contacts, 48 had allegedly been in contact with syphilis and 37 in contact with gonorrhea. The nurses were successful in returning 302 (83 per cent) of the patients to treatment; 3 per cent still remain active; and 14 per cent were lost. Of the contacts, 88 per cent were brought to medical attention. The nurses made 2,118 visits, of which 1,217 were to patients, 252 to contacts and 649 to physicians.

A cost analysis of this service is being made and already discloses that the service is exceedingly expensive.

Follow-Up Service for Syphilis in Pregnancy

This service, conducted jointly by ten Metropolitan Boston prenatal and syphilis clinics and the Community Health Association, has now been under way for more than three years. In 1940 the nurse followed 235 pregnant women in whom 180 pregnancies were terminated. Of the 164 babies, 129 have been examined, none of whom have shown any evidence of congenital syphilis.

Other Diagnostic and Treatment Services

Arsenicals:

The distribution of arsenicals increased tremendously this year from slightly over 59,000 grams in 1939 to 72,400 grams in 1940. This is a greater distribution by more than 1,200 grams above the previous peak in 1937. All of this increase was in the distribution of mapharsen. About 34,000 grams were of standard arsenicals. The distribution of mapharsen amounted to 3,840 grams, which is the equivalent of 38,400 grams of standard arsenicals. Physicians received 27.9 per cent of the total distribution (27.0 per cent in 1939).

Bismuth:

The distribution of bismuth totaled 216,564 cc., a decrease of approximately 26,000 cc. from 1939. Approximately 2,900 sixty cc. bottles were distributed to clinics (3,386 in 1939) and 3,527 twelve cc. bottles to physicians (3,277 in 1939). It is probable that much of the increase in the distribution of mapharsen has replaced the decrease of bismuth used in the clinics where many patients who could not tolerate standard arsenicals and were given bismuth are now being given mapharsen.

Laboratory:

The Wassermann Laboratory reported 334,582 blood and spinal fluid examinations, an increase of 68,500 over 1939. The Bacteriological Laboratory reported 13,070 smears examined for gonorrhea, which was a very slight increase over the number examined in 1939.

Education and Information

During the year the staff lectured to 56 professional and public groups (49 in 1939), reaching 3,669 persons.

One radio broadcast was given this year.

During the year there were distributed 163,380 pieces of literature (177,172 in 1939). The *Bulletin of Genitoinfectious Diseases* was distributed for nine months of the year to every physician in the State.

Training of Personnel

The Harvard School of Public Health continued to offer a course of training for health officers in genitoinfectious disease control, and the Department has continued to co-operate with the Massachusetts Medical Society in the maintenance of a course of postgraduate instruction for physicians.

National Defense

As the result of Selective Service regulations requiring the blood testing of registrants as a part of the general physical examination made by Selective Service Board physicians, the work of the Wassermann Laboratory is being very considerably increased. Up to the end of the year the full force of this increase had not yet been felt. At the same time, the National Guard has decided to have blood tests done on all its personnel, which adds further to the load.

Although the tests are performed at the Department's Wassermann Laboratory, the statistical analyses are being made in this Division. The volume of this work has been such as to take the full time of one of our clerks, which seriously interferes with some of the routine. It may be necessary in the near future to request additional personnel to handle this new emergency work.

Arrangements have been made with the medical officer in charge of the First Corps Area so that one of our nurses may have regular access to the several military establishments in this State for the purpose of interviewing infected soldiers with a view to the identification and follow-up of contacts. Since this work has just been begun, there is no report of accomplishments to be made at this time.

The Department is also attempting the follow-up of all draftees who have positive or doubtful blood tests, with a view to seeing that they receive medical attention wherever necessary. It is beginning to appear that a very large proportion of these infected men are already known to have syphilis and in many cases have received considerable treatment.

The United States Public Health Service has assigned one of its officers to serve as a liaison officer between this Department and the military authorities.

Wherever, as the result of investigation of contacts, there is reason to believe that prostitution is being practiced, the police department responsible for the area in which the offense is alleged to have occurred is notified of the situation.

Table I.—*Reported Gonorrhea and Syphilis*

Year	Gonorrhea				Syphilis			
	Cases	Case Rate per 100,000	Deaths	Death Rate per 100,000	Cases	Case Rate per 100,000	Deaths	Death Rate per 100,000
1936	6,097	139.1	17	0.4	5,524	126.0	196	4.5
1937	5,856	133.0	13	0.3	6,207	140.9	208	4.7
1938	4,938	111.6	5	0.1	5,856	128.2	198	4.5
1939	4,652	104.6	10	0.2	4,888	109.9	204	4.6
1940	4,014	93.0	3	0.1	5,024	116.4	214	5.0

Table II. — *General Paralysis of the Insane*

Year	Deaths		First Admissions to State Institutions for Mental Diseases		
	Deaths	Death Rate per 100,000	First Admissions	Rate per 100,000	Per Cent of All First Admissions
1936	108	2.5	234	5.4	3.9
1937	89	2.0	167	3.8	3.4
1938	90	2.0	188	4.3	3.8
1939	105	2.4	181	4.1	3.7
1940	96	2.2	161	3.7	3.3

Table III.—*New Admissions and Total Visits to Clinics*

Year	New Admissions		Visits to Clinic for Treatment			Number of Clinics
	Gonorrhea	Syphilis	Gonorrhea	Syphilis	Total	
1936	2,388	2,679	83,573	177,029	260,602	26
1937	2,185	2,780	66,937	194,526	261,463	27
1938	2,289	3,034	67,055	206,200	273,255	31
1939	2,171	2,557	64,958	198,124	263,082	31
1940	1,906	2,588	48,263	187,960	236,223	30

Table IV.—*Grams of Arsphenamine, Sulpharsphenamine, Neoarsphenamine and Mapharsen Distributed*

Year	Arsphenamine	Sulpharsphenamine	Neoarsphenamine	Mapharsen[1]	Total	To Physicians	
						Per Cent of Total	Number of Physicians[2]
1936	6,895	2,905	43,714	1,368	54,882	24.7	495
1937	7,458	3,397	43,650	5,162	59,967	28.5	602
1938	5,983	2,556	40,689	6,662	55,890	25.4	632
1939	5,092	1,942	38,003	14,319	59,356	27.3	717
1940	4,360	1,765	27,878	38,397	72,400	27.9	855

[1] Arsphenamine equivalent—grams of mapharsen x 10.

[2] Approximately 7,000 physicians in State.

REPORT OF THE DIVISION OF SANITARY ENGINEERING

Arthur D. Weston, *Chief Sanitary Engineer*

Oversight and Care of Inland Waters

The first comprehensive report of the Division of Sanitary Engineering on matters relating to the oversight of inland waters was that contained in the report of the State Board of Health published in two volumes in the year 1890, entitled:

> "Examinations by the State Board of Health of the Water Supplies and Inland Waters of Massachusetts 1887–1890. Part I of Report on Water Supply and Sewerage" and
> "Experimental Investigations by the State Board of Health of Massachusetts upon the Purification of Sewage by Filtration and by Chemical Precipitation and upon the Intermittent Filtration of Water made at Lawrence, Mass., 1888–1890.
> Part II of Report on Water Supply and Sewerage."

Accordingly, this report may be considered the fiftieth anniversary report on such matters. For that reason and in accordance with the policy of the Department in recent years, the 1940 report of the Division of Sanitary Engineering will contain summary data not published more frequently than once in five years.

Applications for the Advice of the Division

The applications for the advice of the Department during the year 1940 received by the Division of Sanitary Engineering were as follows:

Water Supply		
Municipal and other public water supplies	228	
Water supplies at dairies, semipublic supplies or supplies examined at request of boards of health	214	
Water supplies at schools	13	
Water supplies and sewage disposal at overnight camps or cabins, trailer camps and recreational camps (Chapter 416—Acts of 1939)	657	1,112
Sewerage and Sewage Disposal		
Municipal sewage disposal	110	
*Approval of plans for new sewerage systems and extensions to existing systems	145	255
Miscellaneous Matters		
Sources of ice supply	6	
Bathing, wading and swimming	58	
Shellfish (Areas, etc.)	28	
Pollution of streams	10	
Cross connections	7	
C. C. C. Camps	1	
Institutions (Water supply and sewerage)	11	
Land taking	12	
Rules and regulations	3	
Private well examinations	386†	
Shellfish (Plant inspections)	524	
Miscellaneous	69	1,115†
		2,482

The following table shows the increase in the number of applications received during the past 20 years:

*Chiefly W. P. A. Projects.

†Large increase due to examination of 386 private wells under Federal financial aid.

Year	Water Supply	Sewerage and Sewage Disposal	Miscellaneous Matters	Total
1921	159	18	49	226
1922	152	17	37	206
1923	165 (+60 PW)*	28	44	297
1924	184 (+81 ")	23	59	347
1925	229 (+69 ")	23	59	380
1926	251 (+ 5 ")	37	46	339
1927	327	42	66	435
1928	265	39	92	396
1929	367	28	86	481
1930	452	43	89	584
1931	432	50	129	611
1932	352	24	126	502
1933	336	42	119	497
1934	429	58	175	662
1935	444	69	181	694
1936	618	75	164	857
1937	565	84	346	995
1938	693	157	310	1,160
1939	961	169	625	1,755
1940	1,112	255	1,115	2,482

*Special Private Well Examination.

Many of these applications have required examinations in the field by the engineers and in some cases by representatives of the Water and Sewage Laboratories and of the Lawrence Experiment Station. In most cases the work required chemical analyses and bacterial and microscopical examinations under the direction of the Water and Sewage Laboratories or the Lawrence Experiment Station, or both, and in many cases in connection with the public water supplies tests were made to determine the presence of carbon dioxide and dissolved oxygen, hydrogen-ion concentration and other conditions. Many of these tests were made by engineers in the field and some were made by the chemists and bacteriologists of the Division.

Routine Work

The activities of the Division have been increased considerably during the past year in connection with the construction of the military camps, known as Camp Edwards in Falmouth, Sandwich, Mashpee and Bourne; Fort Devens in the town of Ayer; and Westover Field in Chicopee and Ludlow, and also in connection with certain environmental sanitation studies in the vicinity of these camp sites.

The work of the Division during the year 1940 included:

General advice to cities, towns and persons in matters of water supply, drainage, sewerage and sewage disposal.

Investigations leading to the adoption of rules and regulations for protecting sources of water supply and enforcement of such rules and regulations.

Investigations leading to removal of sources of pollution of water supplies.

Approval of plans for sewerage and works for sewage disposal, including plans in connection with Federal Works Progress Administration Projects.

Investigations relative to the efficiency of the operation of sewage treatment works.

Investigations relative to pollution of streams, examinations of sewer outlets, enforcement of legislation relating to pollution of certain streams and certain coastal waters.

Investigations relative to the use of emergency sources of water supply.

Approval of the acquisition of lands for protecting sources of water supply and lands for sewage treatment works.

Investigations as to effect of industrial wastes on sewers and sewage treatment works.

Investigations leading to approval of plans for police stations, lockups and houses of detention.

Investigations relative to offensive trades.

Investigations relative to the approval of the use of lands for cemetery purposes and for the construction of mausoleums and crematories.

Investigations leading to advice to cities, towns and persons in matters of bathing places, garbage and refuse disposal, nuisances, private water supplies and similar problems.

Investigations relative to sources of water supply where the water is bottled and sold or used in the manufacture of non-alcoholic beverages.

Investigations relative to pollution of water supplies by cross connections.

Investigations as to the location of public institutions.

Preparation of plans for water supply and sewerage for institutions of the Department and certain other state institutions.

Approval of municipal plumbing rules and regulations.

Investigations relative to the pollution of coastal waters from which shellfish are taken.

Investigations relative to sanitary conditions of shellfish handling establishments and consideration of certificates of out-of-state shellfish shippers.

Investigations relative to the approval of shellfish purification plants and the operation thereof.

Representatives of the Division have attended various meetings of the State Planning Board and the Department has been represented on the State Reclamation Board by an engineer of the Division.

Special Investigations

Under Chapter 14 of the Resolves of 1939, the Division assisted the Division of Communicable Diseases in an investigation by the Department of Public Health, in cooperation with the Federal Works Progress Administration, relative to the varieties and prevalence of certain kinds of mosquitoes in the Commonwealth of Massachusetts.

Under Chapter 26 of the Resolves of 1939, the Division conducted an investigation by the Department of Public Health relative to means and methods of remedying the pollution of Martins Pond in the town of North Reading.

Under Chapter 54 of the Resolves of 1939, the Division investigated jointly with the State Reclamation Board relative to the protection of the public health and relief from the mosquito nuisance in the Charles River Valley between Charles River Village and Newton Upper Falls.

Reports relative to these resolves have been filed with the Clerk of the House of Representatives.

In addition to the above the Division also has been called on to carry out a considerable amount of work in connection with the examination of water supplies and works for the disposal of sewage at recreational camps, overnight camps and cabins and trailer camps under the provisions of Chapter 416 of the Acts of 1939.

The Division also has assisted in the work under Chapter 512 of the Acts of 1939 which provided for an engineering study relative to the sewage disposal needs of the North and South Metropolitan Districts and other communities which now or hereafter may be considered in said districts.

Representatives of the Division also have conferred with representatives of the Department of Public Works relative to improvements in rivers and streams for the purpose of protection against flood as provided in Chapter 513 of the Acts of 1939.

Examinations of Public Water Supplies

During the year 1940 a public water supply was introduced in the Lynnfield Water District, and the distribution system of the Lunenburg Water District was completed. In addition the source of supply and a considerable part of the distribution system of the West Boylston Water District were installed. The towns in which these districts are located have previously been supplied in part by public water supplies.

At the present time 256* of the 351 cities and towns of the Commonwealth with an aggregate population of 4,214,578 are considered as having public water supplies. The population of these cities and towns is about 97.6 per cent of 4,316,721, the total population of the State.

*Includes Goshen not previously listed.

There still remain 95 municipalities in the State not considered as having public water supply systems. According to the census of 1940 one of these municipalities has a population of over 6,000, 4 have a population between 4,000 and 5,000, 6 have a population between 2,000 and 3,000, 28 have a population between 1,000 and 2,000 and 56 have a population of less than 1,000. The total population of those municipalities not supplied by public water supplies is 102,143.

The following table summarizes the major additions and improvements made in connection with the public water supplies in the State during the year 1940:

Public Water Supplies—Additions and Improvements

Introduction of Public Water Supplies		
Harvard	Tubular well	Under investigation
Lunenburg		
Lunenburg Water District	Purchase of water from Leominster	Distribution system completed
Lynnfield		
Lynnfield Center Water District	Tubular wells	Completed
West Boylston		
West Boylston Water District	Large tubular well	Completed
Improvements and Extensions of Sources of Supply		
Ayer, Fort Devens	Tubular wells	Under construction
Barre	Tubular well	Completed
Bourne		
Camp Edwards	Four gravel-packed wells	Completed
Braintree	Dam and dike in upper end of Great Pond	Under construction
Chelmsford Water District	Additional tubular wells	Completed
Clinton	Cleaning of reservoirs	Completed
Cummington	Two new springs developed	Completed
Dracut		
Dracut Water Supply District	Additional tubular wells	Investigation under way
Foxborough	Gravel-packed well	Completed
Franklin	Tubular wells.	Pumping test completed
Gardner	Large tubular well supply vs. filtration of Crystal Lake	Under investigation
Gardner		
Gardner State Hospital	Additional tubular wells	Test wells installed
Gill		
Riverside Water Company	New springs developed. Surface water supplies abandoned	Completed
Greenfield	Enlarging Green River well supply	Completed
Hadley		
Hadley Water Supply District	Enlarging upper reservoir in Hart's Brook	Completed
Kingston	Additional tubular wells	Completed
Marblehead	Additional wells	Investigation completed
Marion	Additional tubular wells	Test wells installed
Marshfield	Gravel-packed well	Completed
Maynard	New supply main	Appropriation made
Metropolitan Water District	Quabbin Reservoir and Service Building and allied water works	Substantially completed
	Pressure aqueduct	Completed to terminal chamber
	High level distribution reservoir in the town of Weston	Substantially completed
	Spot Pond by-pass	Substantially completed
	Enlargement of Fells Reservoir	Completed
Monson		
Monson State Hospital	Additional tubular wells	Completed
Newburyport	Improvement of Lower Artichoke Reservoir	Under construction
Northbridge	Additional tubular wells	Test wells installed
Norwood	Gravel-packed well	Completed
Palmer		
Cheney supply in Three Rivers	Deep tubular well	Completed
Plymouth	Tubular wells	Under investigation
Stoughton	Interception of springs by sub-surface drains	Completed
	Gravel-packed well to discharge into conduit	Under construction
Templeton		
Walter E. Fernald State School	New water works system. Dug well and slow sand filters	Completed
West Stockbridge		
West Stockbridge Water Company	Satori Spring supply	Completed
Weston	Deep tubular well	Pumping test made
Winchendon	Test wells	Pumping test made
Wareham	Two gravel-packed wells	Completed
	Additional tubular wells	Test wells installed

Treatment Works Installed or Completed

Great Barrington		
Housatonic Water Works Company . . .	Aerators and slow sand filters at Long Pond	Completed
Monroe		
Monroe Water District .	Slow sand filters, Phelps Brook . .	Completed
Newburyport . . .	Sedimentation and coagulation basins .	Completed but not in operation
Springfield		
Ludlow Supply . .	Reconstruction of Ludlow slow sand filters	Completed

Chemical Treatment for Corrosiveness

Fairhaven		
Fairhaven Water Company . . .	Tubular wells	Chemical treatment
Groton		
Groton Water Company	Dug well	Lime treatment
Lakeville		
Lakeville State Sanatorium	Clear Pond	Lime treatment
Salisbury		
Salisbury Water Supply Co.	Iron removal and corrective treatment .	Experimental plant being operated
Stoughton . . .	Ground water	Under investigation

Permanent Chlorinators Installed

Adams		
Adams Fire District .	Bassett Brook	Chlorinator installed
Great Barrington		
Great Barrington Fire District . . .	East Mountain Reservoir . . .	Chlorinator installed
Hingham		
Hingham Water Company	Fulling Mill Pond Station ground water supply	Chlorinator installed
Holyoke	Whiting Street Reservoir . . .	Chlorinator in process of installation
Lynn	Walnut Street pumping station controlling all water supplied	Chlorinator moved from Ipswich River pumping station
Metropolitan Water .	New Norumbega high level distribution reservoir in the town of Weston . .	Chlorinator installed
Newburyport . . .	New Artichoke River Pumping Station .	Prechlorinator installed
Orange	Coolidge Brook and Crystal Spring reservoir	Chlorinator installed

Permanent Ammoniators Installed

Metropolitan Water . .	New Norumbega high level distribution reservoir in the town of Weston . .	Ammoniators installed in connection with chlorination

Water Supply Statistics

The following tables are arranged to show the various cities and towns in the Commonwealth and the total population of the municipalities, the character of the works of those that are now supplied wholly or in part with water from public works and kind of treatment where purification works have been provided:

City or Town	Date of Introduction	Source of Supply	Population 1940 Census	Services (1940) Number	Services (1940) Per Cent Metered	*P or G	Treatment
Abington	1887	Big Sandy Bottom Pond	5,708	3,629	100	P	Chlorination
Acton	–	. . . .	2,701	–	–	–	– – –
West and South Water Supply District	1912	Tubular Wells	–	674	87	P	– – –
Acushnet	–	. . . .	4,145	–	–	–	– – –
Acushnet Fire and Water District	1916	New Bedford Water Supply	–	648	100	–	– – –
Adams	–	. . . .	12,608	–	–	–	– – –
Adams Fire District	1874	Bassett Brook Reservoir	–	2,372	3	G	Chlorination
		Tubular Wells	–	–	–	P	
		Dry Brook Reservoir (Emergency)	–	–	–	G	– – –
Agawam	1877	Springfield Water Supply	7,842	1,500	100	–	– – –
Alford	——	. . . .	201	–	–	–	– – –
Amesbury	1885	Dug and Tubular Wells	10,682	2,763	20	P	Iron Removal, Chlorination
Amherst	–	. . . .	6,410	–	–	–	– – –
Amherst Water Company	1880	Reservoirs on Amethyst Brook	–	1,587	100	G	
		Atkins Pond and Nourse Brook Diversion (Emergency)	–	–	–	P	Chlorination
Andover	1890	Haggett's Pond	11,122	2,967	98	P	Chlorination
Arlington	1872	Metropolitan Water Supply	40,013	8,252	99	–	– – –
Ashburnham	1870	Upper Naukeag Lake	2,255	427	100	P	Chlorination
Ashby	——	. . . .	1,026	–	–	–	– – –
Ashfield	–	. . . .	872	–	–	–	– – –
Ashfield Water Company	1904	Highland Spring Reservoir	–	94	–	G	– – –
Ashland	1911	Tubular Wells	2,479	572	100	P	– – –
Athol	1875	Thousand Acre Meadow Brook Reservoir	11,180	2,215	98	G	
		Newton Reservoir	–	–	–	G	Rapid Sand Filtration
		Phillipston Reservoir	–	–	–	G	
		Lake Ellis (Emergency)	–	–	–	P	– – –
ATTLEBORO	1873	Dug and Gravel-Packed Wells, Orrs Pond	22,071	4,380	91	P	Corrosive Correction
		Gravel-Packed Wells (Emergency)	–	–	–	P	– – –
Auburn	–	. . . .	6,629	–	–	–	– – –
Auburn Water Company	1920	Tubular Wells	–	699	–	P	– – –
Woodland Park Water District	1935	Worcester Water Supply	–	–	–	–	– – –
Elm Hill Water District	1938	Worcester Water Supply	–	–	–	–	– – –
Avon	1890	Dug and Tubular Wells	2,335	616	83	P	– – –

Ayer	1887	Dug and Tubular Wells	3,572	· 815	88	P	– – –
Barnstable	–		8,333	–	–	–	– – –
Barnstable Water Co.	1912	Tubular Wells	–	1,482	5	P	Corrosive Correction
Barnstable Fire District	1934	Yarmouth Water Supply	–	222	99	–	– – –
Centerville-Osterville Fire District	1938	Gravel-Packed and Tubular Wells	–	505	100	P	– – –
Cotuit Fire District	1936	Gravel-Packed Wells	–	180	100	P	– – –
Barre	1895	Reservoir on Allen Hill	3,528	275	2	G	– – –
		Tubular Well	–	–	–	P	– – –
		Allens Pond (Emergency)	–	–	–	P	– – –
South Barre Wool Combing Company	——	Dug Wells	–	–	–	P	– – –
Becket	——		689	–	–	–	– – –
Bedford	1909	Dug and Tubular Wells	3,807	499	76	P	– – –
Belchertown	–		3,503	–	–	–	– – –
Belchertown Water District	1925	Tubular Wells	–	181	99	P	– – –
Bellingham	1939	Gravel-Packed Wells	2,979	560	100	P	– – –
Belmont	1887	Metropolitan Water Supply	26,867	5,307	100	–	– – –
Berkley	——		1,130	–	–	–	– – –
Berlin	——		1,057	–	–	–	– – –
Bernardston	–		954	–	–	–	– – –
Bernardston Fire and Water District	1936	Dug Well	–	47	–	P	– – –
BEVERLY	1868	Wenham Lake	25,537	5,925	96	P	Rapid Sand Filtration and Chlorination and Ammoniation
		Longham Reservoir	–	–	–	P	
		Ipswich River	–	–	–	P	
Billerica	1898	Gravel-Packed Wells	7,933	1,254	100	P	Iron Removal and Chlorination
David Flowers Water Co.	1915	Billerica Water Supply	–	322	1	–	– – –
Blackstone	1911	Woonsocket, R. I., Water Supply	4,566	79	–	–	– – –
Blandford	–		479	–	–	–	– – –
Blandford Fire District	1909	Freeland Brook Reservoirs	–	131	100	P	– – –
Bolton	——		775	–	–	–	– – –
BOSTON	1848	Metropolitan Water Supply	770,816	101,493	100	–	– – –
Bourne	–		3,315	–	–	–	– – –
Bourne Water District	1939	Gravel-Packed Wells	–	521	100	P	– – –
Buzzards Bay Water District	1937	Tubular Wells	–	169	100	P	– – –
Sagamore—Savery Avenue Supply	1923	Tubular Wells	–	17	–	P	– – –
Sagamore-Knowlton Property Supply	1909	Tubular Wells	–	–	–	P	– – –
Sagamore—Ware Tenement Supply	1914	Tubular Wells	–	68	–	P	– – –
Sagamore Beach Development Company	——	Spring and Tubular Wells	–	–	–	P	– – –
Sagamore Heights Supply	——	Tubular Wells	–	12	–	P	– – –
Sagamore—Keith Block	1914	Tubular Wells	–	–	–	P	– – –
Boxborough	——		376	–	–	–	– – –
Boxford	——		778	–	–	–	– – –
Boylston	——		1,388	–	–	–	– – –
Braintree	1887	Great Pond	16,378	4,741	91	P	Rapid Sand Filtration and Chlorination
Brewster	——		827	–	–	–	– – –
Bridgewater	1888	Tubular Wells	8,902	1,300	100	P	– – –
Brimfield	–		1,012	–	–	–	– – –
Public Buildings Supply	——	Springs	–	–	–	G	– – –
Brimfield Aqueduct Co.	1847	Dug Wells	–	5	–	G	– – –

*Pumping or Gravity.

City or Town	Date of Introduction	Source of Supply	Population 1940 Census	Services (1940) Number	Services (1940) Per Cent Metered	*P or G	Treatment
BROCKTON	1880	Silver Lake	62,343	12,171	96	P	– – –
		Avon Reservoir (Emergency)	–	–	–	P	– – –
Brookfield	1889	Cooley Hill Reservoir	1,393	800	25	G	– – –
		Dug and Tubular Wells (Emergency)	–	–	–	P	Chlorination and Corrosive Correction
Brookline	1875	Gravel-Packed and Tubular Wells	49,786	8,642	100	P}	Iron Removal
		Filter Gallery	–	–	–	P}	
Buckland	——	See Shelburne	1,527	–	–	–	– – –
Burlington	——	. . . . .	2,275	–	–	–	– – –
CAMBRIDGE	1856	Stony Brook Reservoir	110,879	13,996	99	P}	Rapid Sand Filtration and Chlorination
		Hobbs Brook Reservoir	–	–	–	P}	
		Fresh Pond	–	–	–	P}	
Canton	1889	Dug and Tubular Wells	6,381	1,502	100	P	Chlorination and Corrosive Correction
Carlisle	——	. . . . .	747	–	–	–	– – –
Carver	——	. . . . .	1,469	–	–	–	– – –
Charlemont	——	. . . . .	789	–	–	–	– – –
Charlton	——	. . . . .	2,557	–	–	–	– – –
Chatham	–	. . . . .	2,136	–	–	–	– – –
Chatham Water Company	1929	Tubular Wells	–	769	96	P	– – –
		Filter Gallery at White Pond (Emergency)	–	–	–	P	– – –
Chelmsford	–	. . . . .	8,077	–	–	–	– – –
North Chelmsford Fire District	1907	Tubular Wells	–	660	78	P	– – –
Chelmsford Water District	1914	Tubular Wells	–	876	89	P	– – –
East Chelmsford Water District	1934	Lowell Water Supply	–	180	96	–	– – –
South Chelmsford Water District	1936	Chelmsford Water District Supply	–	–	–	–	– – –
CHELSEA	1867	Metropolitan Water Supply	41,259	5,741	100	–	– – –
Cheshire	–	. . . . .	1,708	–	–	–	– – –
Cheshire Water Company	1876	Kitchen Brook Reservoir	–	198	–	G	– – –
		Thunder Brook Reservoir (Emergency)	–	–	–	G	– – –
Chester	1893	Austin Brook Reservoir	1,284	252	–	G	– – –
		Horn Pond	–	–	–	G	– – –
Chesterfield	——	. . . . .	422	–	–	–	– – –
CHICOPEE	1877	Cooley Brook Reservoir	41,664	5,857	98	P	Rapid Sand Filtration and Chlorination
		Morton Brook Reservoir	–	–	–	P	Chlorination
Chilmark	——	. . . . .	226	–	–	–	– – –
Clarksburg	——	. . . . .	1,317	–	–	–	– – –
Clinton	1882	Heywood Pond	12,440	2,641	95	G}	Chlorination
		Lynde Brook Reservoir System	–	–	–	G}	– – –
		Wachusett Reservoir (Emergency)	–	–	–	P	– – –

Cohasset	–		3,111	–	–	–	– – –
Cohasset Water Company	1886	Dug Well and Lily Pond	–	1,069	6	P	Iron Removal, Corrosive Correction and Chlorination
		Tubular Wells (Emergency)	–	–	–	P	Chlorination
Colrain	–		1,497	–	–	–	– – –
Colrain Fire District No. 1	1902	Mountain Brook Reservoir	–	33	94	G	– – –
Kendall Mills Finishing Co. (Griswoldsville)	1901	McClelland Brook Reservoir	–	75	–	G	Chlorination
		Tubular Well (Emergency)	–	–	–	P	– – –
Kendall Mills Finishing Co. (Lyonsville)	——	Springs and Tubular Wells	–	–	–	P	– – –
Concord	1873	Sandy Pond	7,972	1,855	95	G	– – –
		Nagog Pond	–	–	–	G	– – –
Conway	——		944	–	–	–	– – –
Cummington	1916	Springs	608	48	83	P	– – –
Dalton	–		4,206	–	–	–	– – –
Dalton Fire District	1884	Anthony Brook Reservoir	–	1,200	–	G	– – –
		Egypt Brook Reservoir	–	–	–	G	Slow Sand Filtration
		Windsor Reservoir (Emergency)	–	–	–	G	
Danvers	1876	Middleton Pond	14,179	3,457	100	P	Chlorination
		Swan Pond	–	–	–	P	
Dartmouth	1915	New Bedford Water Supply	9,011	1,589	100	–	– – –
Salters Point Supply	1899	Dug Wells	–	–	–	P	– – –
Bay View Supply	——	Ground Water Supply	–	–	–	P	– – –
Houghton Supply	——	Dug Wells	–	–	–	P	– – –
Dedham	–		15,508	–	–	–	– – –
Dedham Water Company	1881	Dug and Tubular Wells	–	4,559	99	P	– – –
Deerfield	–		2,684	–	–	–	– – –
Deerfield Fire District	1911	Springs, Dug and Tubular Wells	–	158	100	G & P	– – –
South Deerfield Water Supply District	1903	Roaring Brook Reservoir	–	–	–	G	Chlorination
Dennis	–		2,015	–	–	–	– – –
Dighton	–		2,983	–	–	–	– – –
North Dighton Water Supply District	1940	Taunton Water Supply	–	–	–	–	– – –
Douglas	1910	Tubular Wells	2,617	310	87	P	– – –
Dover	–		1,374	–	–	–	– – –
Public Building Supply	1927	Tubular Wells	–	–	–	P	– – –
Dracut	–		7,339	–	–	–	– – –
Dracut Water Supply District	1900	Dug and Tubular Wells	–	1,063	92	P	Chlorination and Corrosive Correction
Dudley	1910	Tubular Wells	4,616	463	100	P	– – –
Dunstable	1918	Dug and Tubular Wells	447	28	80	P	– – –
Duxbury	–		2,359	–	–	–	– – –
Duxbury Fire and Water District	1914	Tubular Wells	–	1,010	100	P	– – –
East Bridgewater	1888	Brockton Water Supply	3,832	910	82	–	– – –
East Brookfield	1921	Dug Well	1,016	210	84	P	– – –
East Longmeadow	1913	Springfield Water Supply	3,403	758	94	–	– – –
Eastham	——		582	–	–	–	– – –
Easthampton	1870	Tubular Wells	10,316	3,024	70	P	– – –
Easton			5,135				
North Easton Village District	1887	Dug Well and Spring		820	99	P	– – –
South Easton and Eastondale Fire and Water District	1915	Brockton Water Supply	–	–	–	–	– – –
Easton Center Water District	1936	North Easton Village District Supply	–	–	–	–	– – –
Unionville Fire and Water District	1916	North Easton Village District Supply	–	–	–	–	– – –

*Pumping or Gravity.

City or Town	Date of Introduction	Source of Supply	Population 1940 Census	Services (1940) Number	Services (1940) Per Cent Metered	*P or G	Treatment
Edgartown	–		1,370	–	–	–	– – –
Edgartown Water Co.	1906	Dug and Tubular Wells	–	670	1	P	– – –
Egremont	–		463	–	–	–	– – –
South Egremont Water Co.	1913	Goodale Brook Reservoir	–	102	7	G	Chlorination
Erving	——	See Montague—Millers Falls Fire and Water District	1,328	–	–	–	– – –
Essex	——		1,384	–	–	–	– – –
EVERETT	1867	Metropolitan Water Supply	46,784	7,348	100	–	– – –
Fairhaven	–		10,938	–	–	–	– – –
Fairhaven Water Co.	1894	Tubular Wells	–	2,455	–	P	Corrosive Correction
FALL RIVER	1874	North Watuppa Pond	115,428	13,283	100	P	Chlorination with Ammoniation
Falmouth	1899	Long Pond	6,878	3,190	91	P	Corrosive Correction
FITCHBURG	1872	Ashby Reservoir	41,824	7,250	99	G	– – –
		Lovell Reservoir	–	–	–	G	– – –
		Falulah Reservoir	–	–	–	G	– – –
		Scott Reservoir	–	–	–	G	– – –
		Meetinghouse Pond	–	–	–	G	– – –
		Wachusett Lake	–	–	–	G	– – –
Florida	——		421	–	–	–	– – –
Foxborough	1891	Tubular Wells and Gravel-Packed Well	6,303	1,227	–	P	– – –
Framingham	1885	Gravel-Packed Wells	23,214	4,466	100	P	– – –
		Filter Galleries (Emergency)	–	–	–	P	Chlorination
		Sudbury Aqueduct	–	–	–	P	
Franklin	1884	Dug Wells	7,303	1,433	–	P	Chlorination
Freetown	——		1,584	–	–	–	– – –
GARDNER	1882	Crystal Lake	20,206	3,072	100	G	Chlorination
		Perley Brook Reservoir	–	–	–	G	
Gay Head	——		127	–	–	–	– – –
Georgetown	1935	Tubular Wells	1,803	306	98	P	Iron Removal
Gill	–		931	–	–	–	– – –
Riverside Water Company	1888	Springs	–	74	–	G	– – –
GLOUCESTER	1885	Dike's Meadow Reservoir	24,046	6,859	19	P	Chlorination
		Wallace Brook Reservoir	–	–	–	P	
		Haskell Brook Reservoir	–	–	–	P	
		Babson Reservoir	–	–	–	P	– – –
Goshen	——		237	–	–	–	– – –
Gosnold	——	Dug Well	136	–	–	P	– – –
Grafton	–		7,457	–	–	–	– – –
Grafton Water Company[1]	1886	Dug Wells and Gravel-Packed Well	–	564	100	P	– – –
Saunders Cotton Mill—Saundersville	1838	Springs	–	56	–	G	– – –
		Dug Well (E)	–	–	–	P	– – –
Fisher Manufacturing Co.	——	Springs	–	–	–	G	– – –
		Tubular Wells (E)	–	–	–	P	– – –

Granby	—		1,085	–	–	–	– – –
Granville	–		668	–	–	–	– – –
Granville Center Water Company	1910	Dug Well and Springs	–	22	95	G	– – –
Great Barrington	–		5,824	–	–	–	– – –
Great Barrington Fire District	1867	Filter Gallery Near Green River	–	1,200	79	P	Chlorination
		East Mountain Reservoir	–	–	–	G	
		Lake Mansfield (Emergency)	–	–	–	G	– – –
Housatonic Water Works Company	1888	Long Pond	–	619	1	G	Slow Sand Filtration
Greenfield	1870	Glen Brook Reservoirs	15,672	3,732	99	P	Slow Sand Filtration and Chlorination
		Well and Charging Filter at Green River	–	–	–	P	
Groton	–		2,550	–	–	–	– – –
Groton Water Company	1897	Dug Well	–	390	100	P	Corrosive Correction
West Groton Water Supply District	1912	Tubular Wells	–	164	3	P	– – –
Groveland	1915	Haverhill Water Supply	2,122	622	76	–	– – –
Hadley	–		2,576	–	–	–	– – –
Hadley Water Supply District	1905	Harts Brook Reservoirs	–	343	–	G	– – –
Halifax	—		867	–	–	–	– – –
Hamilton	1939	Gravel-Packed and Tubular Wells	2,037	447	100	P	– – –
Hampden	—		1,023	–	–	–	– – –
Hancock	—		332	–	–	–	– – –
Hanover	1930	Tubular Wells	2,875	662	1	P	– – –
Hanson	1920	Brockton Water Supply	2,570	377	95	–	– – –
		Abington-Rockland Water Supply	–	139			
Hardwick	–		2,154	–	–	–	– – –
Wheelwright, San-Nap-Pak Company	1904	Tubular Wells	–	–	–	P	– – –
Gilbertville—G. H. Gilbert Manufacturing Co.	1887	Dug and Tubular Wells, Springs	–	329	74	P	– – –
Hardwick Center	1913	Dug Well	–	–	–	P	– – –
Harvard	–		1,790	–	–	–	– – –
Harvard Aqueduct Co.	—	Dug Well	–	–	–	P	– – –
Hildreth Bros. Supply	—	Tubular Well and Reservoir	–	–	–	P & G	– – –
Harwich	1936	Gravel-Packed Wells	2,535	364	100	P	– – –
Hatfield	1896	Running Gutter Brook Reservoir	2,216	510	–	G	Chlorination
HAVERHILL	1802	Crystal Lake	46,752	8,095	–	G	Chlorination
		Kenoza Lake	–	–	–	P	
		Round Pond (Emergency)	–	–	–	G	
		Millvale Reservoir	–	–	–	P	
		Johnson's Pond	–	–	–	P	
		Chadwick Pond	–	–	–	P	
		Hovey's Pond	–	–	–	P	
Hawley	—		257	–	–	–	– – –
Heath	—		359	–	–	–	– – –
Hingham	–		8,003	–	–	–	– – –
Hingham Water Company	1880	Accord Pond	–	6,163	45	G	Chlorination
		Collecting System at Fulling Mill Pond	–	–	–	P	Chlorination and Corrosive Correction
Hinsdale	–		1,235	–	–	–	– – –
Hinsdale Fire District	1889	Belmont Reservoir	–	160	–	G	– – –
Holbrook	1888	See Randolph	3,330	–	–	–	– – –
Holden	1905	Muschopauge Pond	3,924	789	99	G	Chlorination

*Pumping or Gravity.
[1] Interconnected with Millbury Water Company.

City or Town	Date of Introduction	Source of Supply	Population 1940 Census	Services (1940) Number	Services (1940) Per Cent Metered	*P or G	Treatment
Holland	–	. . .	247	–	–	–	– – –
Public Building Supply	——	Dug Well	–	–	–	P	– – –
Holliston	–	. . .	3,000	–	–	–	– – –
Holliston Water Company	1891	Gravel-Packed Well	–	456	2	P	– – –
HOLYOKE	1873	Wright and Ashley Ponds	53,750	6,281	8	G	
		Whiting Street Reservoirs	–	–	–	G	
		Hugh McLean Reservoir	–	–	–	G	Chlorination
		Carmody Reservoir	–	–	–	G	
		New Intake Reservoir	–	–	–	G	
		White Reservoir	–	–	–	G	
Hopedale	1881	See Milford	3,113	–	–	–	– – –
Hopkinton	1884	Tubular Wells	2,697	–	–	P	– – –
Hubbardston	——	. . .	1,022	–	–	–	
Hudson	1884	Gates Pond	8,042	1,666	100	G	– – –
		Fosgate Brook	–	–	–	G	– – –
Hull	1882	See Hingham	2,167	–	–	–	– – –
Huntington	–	. . .	1,340	–	–	–	– – –
Huntington Fire District	1899	Cold Brook Reservoir	–	235	–	G	– – –
		Tubular Wells (Emergency)	–	–	–	P	– – –
Ipswich	1894	Dows Brook Reservoir	6,348	1,802	100	P	Chlorination
		Bull Brook Reservoir	–	–	–	P	
Kingston	1886	Tubular Wells	2,783	1,000	–	P	– – –
Lakeville	——	. . .	1,780	–	–	–	– – –
Lancaster	1885	Clinton Water Supply	2,963	618	93	–	– – –
Lanesborough	–	. . .	1,321	–	–	–	– – –
Lanesborough Village Fire and Water District	1939	Tubular Wells	–	131	100	P	– – –
LAWRENCE	1875	Merrimack River	84,323	11,865	98	P	Rapid Sand Filtration, Slow Sand Filtration and Chlorination
Lee	–	. . .	4,222	–	–	–	– – –
Berkshire Water Company	1881	Codding Brook Reservoirs	–	901	–	G	
		Venetti Reservoir	–	–	–	G	Chlorination
		Basin Pond Brook Reservoir	–	–	–	G	
Leicester	–	. . .	4,851	–	–	–	– – –
Leicester Water Supply District	1891	Dug and Tubular Wells	–	–	–	P	– – –
Cherry Valley and Rochdale Water District	1911	Dug Wells and Henshaw Pond	–	385	100	P	– – –
Lenox	–	. . .	2,884	–	–	–	– – –
Lenox Water Company	1875	Root Reservoirs	–	370	100	G	Chlorination
		Ravine and Woolsey Reservoirs	–	–	–	G	– – –
LEOMINSTER	1873	No-Town Reservoir System	22,226	4,166	97	G	Rapid Sand Filtration and Chlorination with Ammoniation
		Morse Reservoir	–	–	–	G	
		Haynes Reservoir	–	–	–	G	Chlorination
		Distributing Reservoir	–	–	–	G	
		Fall Brook Reservoir	–	–	–	G	

Leverett	—	. . . .	688	—	—	—	— — —
Lexington	1884	Metropolitan Water Supply	13,187	2,864	100	—	— — —
Leyden	—	. . . .	260	—	—	—	— — —
Lincoln	1874	Sandy Pond	1,783	480	3	P	— — —
Littleton	1912	Tubular Wells	1,651	440	99	P	. . .
Longmeadow	1895	Springfield Water Supply	5,790	1,608	100	—	— — —
LOWELL	1872	Tubular and Gravel-Packed Wells	101,389	18,132	91	P	Iron Removal and Chlorination
		Tubular Wells (Emergency)	—	—	—	P	
Ludlow	1873	Springfield Water Supply	8,181	—	—	—	— — —
Lunenburg	—	. . . .	2,195	—	—	—	— — —
Lunenburg Water District	1939	Leominster Water Supply	—	294	—	—	— — —
LYNN	1871	Breeds Pond	98,123	18,930	81	P	
		Birch Pond	—	—	—	P	
		Hawkes Pond	—	—	—	P	Chlorination
		Walden Pond	—	—	—	P	
		Ipswich River	—	—	—	P	
		Saugus River	—	—	—	P	
Lynnfield	—	. . . .	2,287	—	—	—	— — —
Lynnfield Water District	1926	Lynn Water Supply	—	260	100	—	— — —
Lynnfield Center Water District	1939	Tubular Wells	—	—	—	P	— — —
Lynnfield Center—Nelson Supply	—	Dug Well	—	—	—	P	— — —
MALDEN	1870	Metropolitan Water Supply	58,010	9,811	100	—	— — —
Manchester	1892	Gravel Pond	2,472	1,147	99	P	Corrosive Correction
		Dug and Tubular Wells	—	—	—	P	— — —
Mansfield	1888	Dug Well	6,530	1,530	85	P	— — —
Marblehead	1885	Dug and Tubular Wells	10,856	4,000	—	P	Iron Removal
Marion	1908	Tubular Wells	2,030	883	72	P	— — —
MARLBOROUGH	1883	Lake Williams	15,154	2,979	92	P	Chlorination
		Millham Brook Reservoir	—	—	—	P	
Marshfield	1928	Dug, Tubular and Gravel-Packed Wells	2,419	2,172	—	P	— — —
Everson Supply—Ocean Bluff	—	Dug Wells	—	—	—	P	— — —
Mashpee	—	. . . .	434	—	—	—	— — —
Mattapoisett	1913	Tubular Wells	1,608	730	6	P	— — —
Maynard	1889	White Pond	6,812	1,535	99	P	Chlorination
Medfield	1889	Medfield State Hospital Supply—	4,384	—	—	—	— — —
		Tubular Wells	—	417	100	P	Corrosive Correction
MEDFORD	1870	Metropolitan Water Supply	63,083	10,878	100	—	— — —
Medway	1911	Dug and Tubular Wells	3,297	805	68	P	Chlorination
MELROSE	1870	Metropolitan Water Supply	25,333	6,347	100	—	— — —
Mendon	—	. . . .	1,315	—	—	—	— — —
Merrimac	1904	Tubular Wells	2,320	689	4	P	— — —
Methuen	1875	Tubular and Gravel-Packed Wells	21,880	4,727	95	P	Chlorination
Metropolitan Water Supply[1]	1895	Quabbin Reservoir	—	—	—	G	
		Ware River Diversion	—	—	—	G	
		Wachusett Reservoir	—	—	—	G	
		Sudbury Reservoir	—	—	—	G	Chlorination and Ammoniation
		Framingham Reservoirs, Nos. 1, 2, 3	—	—	—	G	
		Whitehall Reservoir	—	—	—	G	
		Hopkinton Reservoir	—	—	—	G	
		Ashland Reservoir	—	—	—	G	
		Lake Cochituate (Emergency)	—	—	—	G	

*Pumping or Gravity.

[1]About 50% of Water Pumped into Distribution Systems

City or Town	Date of Introduction	Source of Supply	Population 1940 Census	Services (1940)		*P or G	Treatment
				Number	Per Cent Metered		
Middleborough	1885	Dug Well	9,032	1,457	95	P	Iron Removal
Middlefield	—	. . .	201	–	–	–	– – –
Middleton	1876	See Danvers	2,348	–	–	–	– – –
Milford	–	. . .	15,388	–	–	–	– – –
Milford Water Company	1881	Charles River and Dug Wells	–	3,197	100	P	Slow Sand Filtration, Corrosive Correction and Chlorination with Ammoniation
Millbury	–	. . .	6,983	–	–	–	– – –
Millbury Water Co.[1]	1895	Dug Well	–	964	100	P	– – –
Maple Hillside Water District	1936	Worcester Water Supply	–	55	100	–	– – –
Millis	1891	Dug Wells	2,278	503	60	P	. . .
Millville	—	. . .	1,722	–	–	–	– – –
Milton	1885	Metropolitan Water Supply	18,708	5,042	99	–	– – –
Monroe	–	. . .	207	–	–	–	– – –
Monroe Water District	—	Phelps Brook Reservoirs	–	–	–	G	Slow Sand Filtration
Monson	1895	Dug Wells and Ingalls Brook	5,597	616	93	G }	Chlorination
		Conant Reservoir (Emergency)	–	–	–	G }	
Montague	–	. . .	7,582	–	–	–	– – –
Turners Falls Fire District	1887	Lake Pleasant	–	945	5	P	– – –
Lake Pleasant Water Supply District	1909	Turners Falls Fire District Supply	–	–	–	–	– – –
Millers Falls Fire and Water District	1886	Turners Falls Fire District Supply	–	–	–	–	– – –
Montague Village—E. L. Partlett Supply	1911	Springs	–	112	–	P	– – –
Monterey	–	. . .	320	–	–	–	– – –
Monterey Water Company	1917	Spring-fed Reservoir	–	36	–	G	– – –
Montgomery	—	. . .	178	–	–	–	– – –
Mount Washington	—	. . .	57	–	–	–	– – –
Nahant	1885	Metropolitan Water Supply	1,835	938	100	–	– – –
Nantucket Siasconset (Town)	1913	Dug Wells	–	332	–	P	– – –
Wannacomet Water Company	1878	Dug and Tubular Wells	–	1,891	–	P	– – –
		Wannacomet Pond (Emergency)	–	–	–	P	– – –
Natick	1874	Dug Well	13,851	3,777	100	P	– – –
Needham	1890	Dug and Tubular Wells	12,445	3,695	100	P	Chlorination and Corrosive Correction
		Gravel-Packed Well	–	–	–	P	– – –
New Ashford	—	. . .	87	–	–	–	– – –
New Bedford	1869	Great Quittacas Pond	110,341	21,762	98	P	– – –
		Little Quittacas Pond	–	–	–	P	– – –
New Braintree	—	. . .	439	–	–	–	– – –
New Marlborough	–	. . .	956	–	–	–	– – –
Mill River Water Supply Company	—	Spring	–	24	–	G	– – –
Southfield Water Trust	1870	Springs	–	28	–	G	– – –
Southfield—H. A. Cook	1913	Springs	–	–	–	G	– – –
New Salem	—	. . .	357	–	–	–	– – –

Newbury	——	See Newburyport	1,599	–	–	–	– – –
NEWBURYPORT	1881	Artichoke River Reservoirs	13,916	4,200	3	P	[2]
		Dug and Tubular Wells and Spring	–	–	–	P	
NEWTON	1876	Dug Wells and Infiltration Conduit	69,873	16,621	100	P	Chlorination with Ammoniation and Corrosive Correction
Norfolk	——	. . . .	2,294	–	–	–	– – –
NORTH ADAMS	1861	Notch Brook Reservoir	22,213	3,621	100	G	– – –
		Broad Brook Reservoir	–	–	–	G	Chlorination
		James Brook Reservoir	–	–	–	G	Chlorination
		Mount Williams Reservoir	–	–	–	G	– – –
		Tubular Wells (Emergency)	–	–	–	P	Chlorination
North Andover	1898	Great Pond	7,524	1,702	100	P	Chlorination
North Attleborough	1884	Dug Wells	10,359	1,872	98	P	Corrosive Correction
North Brookfield	1893	Doane Pond	3,304	600	1	P	Chlorination
		North Pond	–	–	–	P	
North Reading	1936	Wilmington Water Supply	2,886	398	100	–	– – –
NORTHAMPTON	1871	Mountain Street Reservoir	24,794	4,534	100	G	
		Avery Brook Reservoir	–	–	–	G	Chlorination
		Roberts Meadow Brook Reservoirs	–	–	–	G	
Northborough	1882	Cold Harbor Brook Reservoir	2,382	515	99	G	Slow Sand Filtration, Chlorination and Corrosive Correction
Northbridge	–	Whitin Machine Works Supply	10,242	385	23	–	– – –
Whitin Machine Works	1889	Tubular Wells	–	–	–	P	– – –
Paul Whitin Manufacturing Company	——	Dug and Tubular Wells	–	–	–	P	– – –
Northfield	–	. . . .	1,975	–	–	–	– – –
Northfield Water Company	1900	Minot Brook Reservoir	–	113	90	G	– – –
Northfield Schools, Incorporated	1879	Louisiana Brook Reservoirs and Glen Spring	–	14	–	G & P	Slow Sand Filtration and Chlorination
East Northfield Water Company	——	Northfield Schools, Incorporated, Supply	–	124	–	–	– – –
Norton	1912	Tubular Wells	3,107	452	6	P	– – –
Norwell	——	. . . .	1,871	–	–	–	– – –
Norwood	1885	Tubular Wells and Gravel-Packed Well	15,383	2,948	99	P	Iron Removal
		Buckmaster Pond	–	–	–	P	Slow Sand Filtration
Oak Bluffs	–	. . . .	1,584	–	–	–	– – –
Cottage City Water Company	1890	Springs	–	1,544	86	P	Corrosive Correction
Oakham	——	. . . .	423	–	–	–	– – –
Orange	1873	Crystal Spring	5,611	1,073	100	P	Chlorination
		Coolidge Brook Reservoir	–	–	–	P	
Orleans	——	. . . .	1,451	–	–	–	– – –
Otis	——	. . . .	364	–	–	–	– – –
Oxford	–	. . . .	4,623	–	–	–	– – –
Oxford Water Company	1906	Tubular Wells	–	677	100	P	– – –
Palmer	–	. . . .	9,149	–	–	–	– – –
Palmer Fire District No. 1	1920	Graves Brook Reservoirs	–	655	65	G	Chlorination
		Tubular Wells (Emergency)	–	–	–	P	– – –
Bondsville Water Company	1908	Tubular Wells	–	292	7	P	– – –
Thorndike Village—J. J. Kelly Supply	–	Spring	–	15	–	G	– – –
Thorndike Village—William Holden Supply	1919	Reservoir and Springs	–	114	6	G	– – –

[1]Interconnected with Grafton Water Company.
[2]Slow Sand Filtration and Chlorination of Artichoke River Water; Slow Sand Filtration of Mixed Ground and Filtered Artichoke River Water.
*Pumping or Gravity.

City or Town	Date of Introduction	Source of Supply	Population 1940 Census	Services (1940) Number	Services (1940) Per Cent Metered	*P or G	Treatment
Palmer—Concluded							
Three Rivers—Cheney	—	Spring-fed Collecting Well	–	392	99	G	– – –
		Tubular Wells	–	–	–	P	– – –
Three Rivers—Cheney-Wilson Supply	—	Tubular Well	–	–	–	P	– – –
J. P. T. Berlanger Supply	—	Dug Well	–	–	–	P	– – –
Otis Company Supply (Seven Separate Systems)	—	Springs	–	–	–	G	– – –
Paxton	1934	Springs	791	103	98	P	– – –
Peabody	1799	Spring Pond	21,711	4,554	88	P	Chlorination
		Tapley Brook Reservoir	–	–	–	P	
		Suntaug Lake	–	–	–	P	
		Ipswich River (Emergency)	–	–	–	P	
Pelham	—	. . . .	568	–	–	–	– – –
Pembroke	1913	Brockton Water Supply	1,718	244	98	–	– – –
Pepperell	1909	Tubular Wells	3,114	735	97	P	– – –
Peru	—	. . . .	142	–	–	–	– – –
Petersham	—	. . . .	923	–	–	–	– – –
Phillipston	—	. . . .	481	–	–	–	– – –
Pittsfield	1855	Ashley Lake	49,684	9,406	6	G	Chlorination
		Lower Ashley Reservoir	–	–	–	G	
		Sackett Reservoir	–	–	–	G	
		Hathaway Reservoir	–	–	–	G	
		Sand Wash Brook Reservoir	–	–	–	G	
		Farnham Reservoir	–	–	–	G	– – –
		Mill Brook Reservoir	–	–	–	G	– – –
		Onota Lake (Emergency)	–	–	–	P	– – –
Junction Water Company	1890	Brattle Brook Reservoir	–	24	–	G	– – –
Plainfield	—	. . . .	264	–	–	–	– – –
Plainville	1909	North Attleborough Water Supply	1,302	322	65	–	– – –
Plymouth	1855	Little South Pond	13,100	3,442	78	P	– – –
		Great South Pond	–	–	–	P	– – –
		Boot Pond	–	–	–	P	– – –
		Lout Pond (Emergency)	–	–	–	P	– – –
Plympton	—	. . . .	532	–	–	–	– – –
Princeton	—	. . . .	713	–	–	–	– – –
Provincetown	1893	Gravel-Packed Wells	3,668	1,377	–	P	Iron Removal
		Tubular Wells	–	–	–	P	– – –
Quincy	1884	Metropolitan Water Supply	75,810	16,608	100	–	– – –
Randolph	1888	Great Pond	7,634	–	–	P	Rapid Sand Filtration and Chlorination
Raynham	—	. . . .	2,141	–	–	–	– – –
Reading	1891	Tubular Wells	10,866	2,952	100	P	Iron Removal
Rehoboth	—	. . . .	2,736	–	–	–	– – –

REVERE	1884	Metropolitan Water Supply	34,405	6,430	100	–	– – –
Richmond	——		624	–	–	–	– – –
Rochester	——		1,269	–	–	–	– – –
Rockland	1887	See Abington	8,087	–	–	–	– – –
Rockport	1895	Cape Pond	3,556	1,882	3	P	Rapid Sand Filtration and Chlorination
		Tubular Wells	–	–	–	P	Corrosive Correction
Rowe	——		233	–	–	–	– – –
Rowley	——		1,533	–	–	–	– – –
Royalston	——		795	–	–	–	– – –
Russel	1911	Black Brook Reservoir	1,242	241	2	G	Slow Sand Filtration
		Gravel-Packed Well	–	–	–	P	– – –
Rutland	1896	Muschopauge Pond	2,181	203	96	P	Chlorination
SALEM	1868	See Beverly	41,213	8,585	94	–	– – –
Salisbury	–		2,376	–	–	–	– – –
Salisbury Water Supply Company	1915	Gravel-Packed and Dug Wells	–	824	1	P	– – –
Rings Island Water District	1936	Salisbury Water Supply Company Supply	–	–	–	–	– – –
Sandisfield	——		421	–	–	–	– – –
Sandwich	——		1,360	–	–	–	– – –
Saugus	1878	Lynn Water Supply	14,825	3,800	97	–	– – –
		Melrose Water Supply (Golden Hill)	–	–	–	–	– – –
Savoy	——		300	–	–	–	– – –
Scituate	1901	Gravel-Packed Wells (Bound Brook)	4,130	2,775	32	P	Corrosive Correction
		Gravel-Packed Wells (Webster Meadows)	–	–	–	P	– – –
		Tubular Wells and Spring	–	–	–	P	– – –
		Old Oaken Bucket Pond (Emergency)	–	–	–	P	Rapid Sand Filtration and Chlorination
Seekonk	——		4,912	–	–	–	– – –
Sharon	1885	Tubular Wells	3,737	1,049	4	P	– – –
		Dug and Tubular Wells (Emergency)	–	–	–	P	– – –
Sheffield	–		1,709	–	–	–	– – –
Sheffield Water Company	1897	Springs	–	149	3	G	– – –
Shelburne	–		1,636	–	–	–	– – –
Shelburne Falls Fire District	1912	Fox Brook Reservoirs	–	544	98	G	– – –
Sherborn	——		1,022	–	–	–	– – –
Shirley	–		2,608	–	–	–	– – –
Shirley Village Water District	1903	Dug Wells	–	370	87	P	– – –
Shrewsbury	1915	Gravel-Packed and Tubular Wells	7,586	1,782	97	P	– – –
Shutesbury	——		191	–	–	–	– – –
Somerset	1927	Tubular Wells	5,873	1,143	100	P	– – –
SOMERVILLE	1867	Metropolitan Water Supply	102,177	13,834	99	–	– – –
South Hadley	–		6,856	–	–	–	– – –
South Hadley Fire District No. 1	1872	Leaping Well Brook Reservoir	–	–	–	P	Chlorination
		Buttery Brook Reservoir	–	–	–	P	
South Hadley Fire District No. 2	1911	Dug Wells and Filter Gallery	–	–	–	P	– – –
		Elmer Brook (North Branch)	–	326	100	P	Slow Sand Filtration (Seasonal)
Southampton	1900	Holyoke Water Supply	950	–	–	G	– – –
Southborough	1930	Sudbury Reservoir	2,231	375	100	P	Chlorination
Southbridge	–		16,825	–	–	–	– – –
Southbridge Water Supply Company	1880	Hatchet Brook Reservoirs	–	2,228	95	G	Slow Sand Filtration and Chlorination

*Pumping or Gravity.

City or Town	Date of Introduction	Source of Supply	Population 1940 Census	Services (1940) Number	Services (1940) Per Cent Metered	*P or G	Treatment
Southwick	1930	Springfield Water Supply	1,579	205	75	–	– – –
Spencer	1883	Shaw Pond	6,641	1,000	90	G	– – –
Springfield	1874	Ludlow Reservoir	149,554	–	–	G	Slow Sand Filtration
		Cobble Mountain Reservoir	–	–	–	G	
		Borden Brook Reservoir	–	–	–	G	
		Little River Intake Reservoir	–	–	–	G	
Sterling	1935	Tubular Wells	1,713	120	97	P	– – –
Stockbridge	–	. . .	1,815	–	–	–	– – –
Stockbridge Water Company	1862	Lake Averic	–	496	31	P	Chlorination
		Bear Mountain Reservoir	–	–	–	G	– – –
Hill Water Company	1885	Springs	–	17	–	G	– – –
Stoneham	1883	Metropolitan Water Supply	10,765	2,545	100	–	– – –
Stoughton	1886	Muddy Pond	8,632	2,150	94	P	Chlorination
Stow	——	. . .	1,243	–	–	–	– – –
Sturbridge	1906	Tubular Wells	2,227	194	99	P	– – –
Sudbury	1936	Tubular Wells	1,754	125	83	P	– – –
Sunderland	——	. . .	1,085	–	–	–	– – –
Sunderland Water Company	1883	Saw Mill Brook Reservoirs	–	126	–	G	– – –
Sutton	–	. . .	2,749	–	–	–	– – –
Sutton Water Company	1915	Dug Well and Tubular Well	–	85	79	P	– – –
Swampscott	1885	Metropolitan Water Supply	10,761	2,899	100	–	– – –
Swansea	——	. . .	4,684	–	–	–	– – –
Taunton	1876	Elders Pond	37,395	7,879	99	P	– – –
		Assawompsett Pond	–	–	–	P	– – –
Templeton	——	. . .	4,601	–	–	–	– – –
Tewksbury	——	. . .	6,261	–	–	–	– – –
Tisbury	1887	Spring	1,966	786	2	P	– – –
Tolland	——	. . .	129	–	–	–	– – –
Topsfield	–	. . .	1,150	–	–	–	– – –
Topsfield Water Company, Incorporated	1912	Tubular Well	–	25	8	P	– – –
Townsend	1934	Tubular Wells	2,065	386	–	P	– – –
Truro	——	. . .	585	–	–	–	– – –
Tyngsborough	——	. . .	1,634	–	–	–	– – –
Tyringham	——	. . .	213	–	–	–	– – –
Upton	–	. . .	2,249	–	–	–	– – –
William Knowlton and Sons Company	——	Tubular Wells and Springs	–	70	89	P	– – –
Uxbridge	1879	Tubular Wells and Springs	6,417	948	99	P & G	– – –
Wakefield	1883	Crystal Lake	16,223	3,937	99	P	Slow Sand Filtration and Chlorination
		Tubular Wells	–	–	–	P	– – –
Wales	——	. . .	367	–	–	–	– – –
Walpole	1896	Tubular Wells	7,443	1,838	100	P	– – –
Waltham	1873	Dug Wells	40,020	6,789	94	P	– – –

Ware	1886	Tubular and Dug Wells	7,557	1,096	100	P	Corrosive Correction
Wareham	–	. . . .	6,364	–	–	–	– – –
Onset Fire District	1894	Jonathan Pond	–	1,740	–	P	– – –
Wareham Fire District	1908	Gravel-Packed and Tubular Wells	–	1,552	25	P	– – –
Warren	–	. . . .	3,531	–	–	–	– – –
Warren Water District	1923	Tubular Wells	–	425	1	P	– – –
West Warren Water Company	1912	Dug Wells	–	327	1	P	– – –
Warwick	——	. . . .	444	–	–	–	– – –
Washington	——	. . . .	267	–	–	–	– – –
Watertown	1885	Metropolitan Water Supply	35,427	6,097	100	–	– – –
Wayland	1878	Gravel-Packed and Tubular Wells	3,505	1,070	17	P	– – –
Webster	1881	Tubular Wells and Filter Gallery	13,186	1,781	95	P	– – –
Wellesley	1884	Tubular Wells, Dug Wells and Filter Gallery	15,127	4,567	100	P	– – –
		Gravel-Packed Well	–	–	–	P	– – –
Wellfleet	——	. . . .	890	–	–	–	– – –
Wendell	——	. . . .	391	–	–	–	– – –
Wenham	——	. . . .	1,220	–	–	–	– – –
West Boylston	–	. . . .	1,822	–	–	–	– – –
West Boylston Water District	1940	Tubular Well	–	–	–	P	– – –
Pinecroft Water District	1933	Worcester Water Supply	–	–	–	–	– – –
West Bridgewater	1911	Brockton Water Supply	3,247	1,137	100	–	– – –
West Brookfield	1913	Tubular Wells	1,387	278	92	P	– – –
West Newbury	1936	Groveland Water Supply	1,515	–	–	–	– – –
West Springfield	1875	Bear Hole Brook Reservoirs	17,135	–	–	P	Slow Sand Filtration and Chlorination
		Gravel-Packed Wells	–	–	–	P	– – –
West Stockbridge	–	. . . .	1,062	–	–	–	– – –
West Stockbridge Water Company	1873	East Mountain Reservoir and Springs	–	112	–	G	– – –
West Tisbury	——	. . . .	260	–	–	–	– – –
Westborough	1879	Filter Basin	6,463	943	–	G	– – –
WESTFIELD	1874	Granville Reservoir	18,793	3,331	7	G	
		Japhet Brook Reservoir	–	–	–	G	
		Winchell Reservoir	–	–	–	G	Chlorination
		Montgomery Reservoir	–	–	–	G	
		Tekoa Reservoir	–	–	–	G	
Westford	–	. . . .	3,830	–	–	–	– – –
Westford Water Company	1908	Dug and Tubular Wells	–	502	100	P	– – –
Abbot Worsted Company	——	Tubular Wells	–	–	–	P	– – –
Westhampton	–	. . . .	403	–	–	–	– – –
Westhampton Water Company	1894	Mountain Brook Reservoir	–	25	–	G	– – –
Westminster	–	. . . .	2,126	–	–	–	– – –
Westminster Aqueduct Company	1890	Springs	–	50	–	G	– – –
Weston	1896	Dug and Tubular Wells	3,590	796	100	P	– – –
Weston Water Company	——	Dug Wells	–	66	100	P	– – –
Glen Farms Water Company	1919	Dug Well	–	25	100	P	– – –
Keewaydin Water Works	——	Tubular Wells	–	25	56	P	– – –
R. B. Rand Supply	——	Dug Well	–	–	–	P	– – –
Westport	——	. . . .	4,134	–	–	–	– – –
Westwood	1930	Dedham Water Company Supply	3,376	–	–	–	– – –
Westwood Water Company	1901	Tubular Wells	–	170	2	P	– – –
Weymouth	1885	Great Pond	23,868	7,508	86	P	Rapid Sand Filtration

*Pumping or Gravity.

City or Town	Date of Introduction	Source of Supply	Population 1940 Census	Services (1940) Number	Services (1940) Per Cent Metered	*P or G	Treatment
Whately	–		979	–	–	–	– – –
Homer L. Crafts Supply	——	Springs	–	–	–	P & G	– – –
Allis Estate Water Supply	1898	Springs	–	40	–	G	– – –
Whitman	1883	Brockton Water Supply	7,759	1,987	100	–	– – –
Wilbraham	1929	Springfield Water Supply	3,041	277	100	–	– – –
Williamsburg	1903	Unquomonk Brook Reservoirs	1,684	400	3	G	Chlorination
Williamstown	–		4,294	–	–	–	– – –
Williamstown Water Company	1859	Paul Brook	–	705	100	G	Chlorination
		Sherman Spring Reservor	–	–	–	G	– – –
		Rattlesnake Brook Reservoir	–	–	–	G	– – –
		Cold Spring	–	–	–	G	– – –
Wilmington	1928	Tubular Wells	4,645	802	20	P	– – –
Winchendon	1896	Dug Wells	6,575	1,364	95	P	– – –
Winchester	1873	North Reservoir	15,081	3,464	100	G	– – –
		South Reservoir	–	–	–	G	Chlorination
		Middle Reservoir	–	–	–	G	
		Tubular Wells	–	–	–	P	– – –
Windsor	——		314	–	–	–	– – –
Winthrop	1884	Metropolitan Water Supply	16,768	3,948	100	–	– – –
Woburn	1873	Gravel-Packed Wells	19,751	4,666	92	P	– – –
Worcester	1845	Kettle Brook Reservoirs Nos. 1, 2, 3, 4	193,694	31,461	90	G	– – –
		Lynde Brook Reservoir	–	–	–	G	– – –
		Kendall Reservoir	–	–	–	G	– – –
		Pine Hill Reservoir	–	–	–	G	– – –
		Quinapoxet Pond	–	–	–	G	– – –
Worthington	–		471	–	–	–	– – –
Worthington Fire District	1911	Springs	–	73	–	G	– – –
Wrentham	1908	Dug and Tubular Wells	4,674	717	95	P	– – –
Yarmouth	1931	Tubular Wells	2,286	207	3	P	– – –

*Pumping or Gravity.

Summary of Water Treatment

City or Town	Date of Installation	Present Rated Capacity of Plant (M.G.D.)	Average Output (M.G.D)	Supply	Treatment	Laboratory Control
					Rapid Sand Filtration Plants	
Athol	1937	1.00	0.550	Surface	Aeration, Coagulation, Sedimentation, Rapid Sand Filtration, Corrosive Correction	None
Braintree	1934	2.50	1.426	Surface	Coagulation, Activated Carbon, Sedimentation, Rapid Sand Filtration, Corrosive Correction and Chlorination	Chemical
Cambridge	1922	22.90	12.272	Surface	Coagulation, Sedimentation, Rapid Sand Filtration, Aeration, Corrosive Correction and Chlorination	Chemical and Bacteriological
*Chicopee	1931	5.00	–	Surface	Aeration, Coagulation, Sedimentation, Rapid Sand Filtration, Corrosive Correction and Chlorination	Chemical and Bacteriological
Lawrence	1938	10.30	4.335	Surface	Coagulation, Sedimentation, Rapid Sand Filtration, Aeration, Slow Sand Filtration and Chlorination	Chemical and Bacteriological
*Leominster	1937	2.00	1.216	Surface	Coagulation, Sedimentation, Rapid Sand Filtration, Corrosive Correction, Chlorination with Ammoniation	Chemical
Randolph and Holbrook	1936	2.00	0.649	Surface	Coagulation, Sedimentation, Rapid Sand Filtration, Corrosive Correction and Chlorination	None
*Rockport	1939	1.00	–	Surface	Aeration, Coagulation, Sedimentation, Rapid Sand Filtration	None
Salem and Beverly	1935	9.60	5.682	Surface	Coagulation, Activated Carbon, Sedimentation, Rapid Sand Filtration, Corrosive Correction, and Chlorination with Ammoniation	Chemical and Bacteriological
*Scituate	1924	1.50	–	Surface	Coagulation, Sedimentation, Rapid Sand Filtration and Chlorination	
Weymouth	1935	4.00	1.312	Surface	Aeration, Coagulation, Sedimentation, Rapid Sand Filtration and Corrosive Correction	Chemical
					Slow Sand Filtration Plants	
Dalton						
Dalton Fire District	1939	1.20	1.239	Surface	Sedimentation and Slow Sand Filtration	None
Great Barrington						
Housatonic Water Works Company	1935		0.748	Surface	Slow Sand Filtration	None
Greenfield	1935	2.00	1.379	Surface	Coagulation (Seasonal), Sedimentation, Slow Sand Filtration and Chlorination	Chemical
Milford and Hopedale						
Milford Water Company	1896		0.805	Ground and Surface	Slow Sand Filtration, Corrosive Correction and Chlorination with Ammoniation	Chemical and Bacteriological
Monroe						
Monroe Water District				Surface	Slow Sand Filtration	None
Newburyport	1934	2.00	1.569	Ground and Surface	Chlorination and Slow Sand Filtration of Surface Water, Slow Sand Filtration of Mixed Ground and Surface Water	None

*Certain of the Sources only.

City or Town	Date of Installation	Present Rated Capacity of Plant (M.G.D.)	Average Output (M.G.D)	Supply	Treatment	Laboratory Control
Northborough	1936	0.33	–	Surface	Coagulation, Sedimentation, Slow Sand Filtration, Corrosive Correction and Chlorination	
Northfield						
Northfield Schools, Inc.	1915	0.14	–	Ground and Surface	Slow Sand Filtration and Chlorination	None
*Norwood	1913	1.30		Surface	Aeration, Slow Sand Filtration	None
*Russell	1937	0.13	0.003	Surface	Sedimentation, Slow Sand Filtration	None
*South Hadley						
South Hadley Fire District No. 2	1931	0.14	–	Surface	Slow Sand Filtration	None
Southbridge						
Southbridge Water Supply Company	1908	1.20	0.644	Surface	Aeration, Slow Sand Filtration and Chlorination	None
Springfield—West Parish	1909	30.00	16.593	Surface	Coagulation (Seasonal), Sedimentation, Aeration and Slow Sand Filtration	Chemical and Bacteriological
—Ludlow	1906	3.20	2.447	Surface	Slow Sand Filtration	Chemical and Bacteriological
*Wakefield	1928	2.50	0.661	Surface	Aeration, Slow Sand Filtration and Chlorination	Chemical and Bacteriological
*West Springfield	1907	2.00	1.308	Surface	Aeration, Slow Sand Filtration and Chlorination	None
					Iron Removal Plants	
Amesbury	1927	1.50	0.746	Ground	Aeration, Coke Filtration, Sedimentation, Slow Sand Filtration and Chlorination	Chemical and Bacteriological
Billerica	1932	0.50	0.324	Ground	Aeration, Sedimentation and Chlorination	None
Brookline	1918	9.60	4.578	Ground	Aeration, Coke Filtration, Sedimentation and Slow Sand Filtration	None
Cohasset						
Cohasset Water Company	1913	1.00	0.313	Ground and Surface	Aeration with Coke, Coagulation, Sedimentation, Rapid Sand Filtration, Chlorination, Corrosive Correction (Lily Pond Preliminary Filtration)	Chemical and Bacteriological
Georgetown	1935	0.14	–	Ground	Aeration and Coke Filtration	None
Lowell	1916	10.00	5.597	Ground	Aeration, Coke Filtration, Sedimentation, Slow Sand Filtration and Chlorination	Chemical and Bacteriological
Marblehead	1909	3.00	0.731	Ground	Aeration, Sedimentation and Slow Sand Filtration	None
Middleborough	1913		0.310	Ground	Aeration, Coke Filtration, Sedimentation and Slow Sand Filtration	None
Norwood	1937	2.00	0.691	Ground	Aeration, Coke Filtration, Sedimentation and Slow Sand Filtration	None
*Provincetown	1939	0.44	–	Ground	Aeration, Marble Filtration, Coke Filtration, Sedimentation and Slow Sand Filtration	None
Reading	1936	1.50	0.671	Ground	Aeration, Coke Filtration, Sedimentation, Slow Sand Filtration	Chemical and Bacteriological

*Certain of the Sources only.

Summary of Water Treatment—Continued

Chlorination

Abington and Rockland
Adams
  Adams Fire District
Amesbury
Amherst
  Amherst Water Company
Andover
Ashburnham
Billerica
Braintree
Brookfield (Emergency supply only)
Cambridge
Canton
Chicopee
Clinton
Cohasset
*Colrain
  Kendall Mills Finishing Co.
Danvers and Middleton
Deerfield
  South Deerfield Water Supply District
Dracut
  Dracut Water Supply District
Egremont
  South Egremont Water Co.
Fall River**
*Framingham
Franklin
Gardner
Gloucester
Great Barrington
  Great Barrington Fire District
Greenfield
Hatfield
Haverhill
Hingham
Holden
Holyoke
Ipswich
Lawrence
Lee
  Berkshire Water Company
*Lenox
  Lenox Water Co.
Leominster**
Lowell
Lynn
Marlborough
Maynard
Medway
Methuen
Metropolitan District**
Milford and Hopedale
  Milford Water Company
Monson
*Needham
*Newburyport
Newton**
*North Adams
Northampton
North Andover
Northborough
North Brookfield
Northfield
  Northfield Schools, Inc.
Orange
Palmer
  Palmer Fire District No. 1
Peabody
Pittsfield
Randolph and Holbrook
*Rockport
Rutland
Salem and Beverly**
Scituate (Emergency supply only)
Southborough
Southbridge
  Southbridge Water Supply Co.
South Hadley
  South Hadley Fire Dist. No. 1
*Stockbridge
  Stockbridge Water Co.
Stoughton
*Wakefield
Westfield
*West Springfield
Williamsburg
*Williamstown
  Williamstown Water Co.
*Winchester

*Certain of the Sources only.
**Ammoniation in conjunction with chlorination.

Corrosive Correction

(Natural Waters)

City or Town	*Supply*
*Attleboro	Ground
*Barnstable	
Barnstable Water Company	Ground
*Brookfield	Emergency ground supply only
*Canton	Ground
Cohasset	
Cohasset Water Company	Ground
*Dracut	
Dracut Water Supply District	Ground
Fairhaven	
Fairhaven Water Company	Ground
Falmouth	Surface
Groton	
Groton Water Company	Ground
*Hingham	
Hingham Water Company	Ground
*Manchester	Surface
Medfield	Ground
Milford	
Milford Water Company	Surface and ground
*Needham	Ground
Newton	Ground
North Attleborough	Ground
Northborough	Surface
Oak Bluffs	
Cottage City Water Company	Ground
*Rockport	Ground
*Scituate	Ground
Ware	Ground

*Certain of the sources only.

The 95 municipalities not provided with public water supplies at the end of 1940, with their populations according to the 1940 Federal census, are shown in the following table:

Town	*Population*
Alford	201
Ashby	1,026
Becket	689
Berkley	1,130
Berlin	1,057
Bolton	775
Boxborough	376
Boxford	778
Boylston	1,388
Brewster	827
Brimfield	1,012
Public building supply and Aqueduct Company supplying a few houses	
Burlington	2,275
Carlisle	747
Carver	1,469
Charlemont	789
Fire service supply not approved for domestic use	
Charlton	2,557
Chesterfield	422
Chilmark	226
Clarksburg	1,317
Conway	944
Dennis	2,015
Dover	1,374
Public building supply	
Eastham	582
Essex	1,384
Conomo Point (summer resort) supplied from Gloucester system	
Florida	421
Freetown	1,584
Gay Head	127
Goshen	237
Granby	1,085
Halifax	867
Hampden	1,023
Hancock	332
Harvard	1,790
Includes part of Fort Devens which has its own supply. Portion of Harvard Village supplied by Harvard Aqueduct Company and the Hildreth Bros. Supply. Legislation for municipal supply accepted Possible sources being investigated	
Hawley	257
Heath	359
Holland	247
Public building supply	
Hubbardston	1,022
Lakeville	1,780
Includes Lakeville State Sanatorium (population 483) with private supply	
Leverett	688
Leyden	260
Mashpee	434
Mendon	1,315
Middlefield	201
Millville	1,722
Montgomery	178
Mount Washington	57
New Ashford	87
New Braintree	439
Newbury	1,599
Certain premises supplied by Newburyport	
New Marlborough	959
Certain villages supplied in part by: Mill River Water Supply Co. Southfield Water Trust Southfield—H. A. Cook	
New Salem	357
Norfolk	2,294
Includes Pondville Hospital (population 323) and Norfolk State Prison Colony (population 1,037) which have private supplies	
Norwell	1,871
Oakham	423
Orleans	1,451
Otis	364
Pelham	568
Peru	142
Petersham	923
Phillipston	481
Plainfield	264
Plympton	532
Princeton	713
Raynham	2,141
Rehoboth	2,736
Richmond	624
Rochester	1,269
Rowe	233
Rowley	1,533
Royalston	795
Sandisfield	421
Sandwich	1,360
Savoy	300
Seekonk	4,912
Sherborn	1,022
Shutesbury	191
Stow	1,243
Swansea	4,684
Templeton	4,601
Includes Templeton Colony of the Walter E. Fernald State School (population 351) and Hospital Cottages for Children (population 191) which have private supplies	
Tewksbury	6,261
Includes Tewksbury State Hospital and Infirmary (population 3,450) which has a private supply	
Tolland	129
Topsfield	1,150
Topsfield Village supplied in part by Topsfield Water Company	
Truro	585
Tyngsborough	1,634
Tyringham	213
Wales	367
Warwick	444
Washington	267
Wellfleet	890
Wendell	391
Wenham	1,220
Westport	4,134
West Tisbury	260
Whately	979
Certain premises supplied by the Crafts supply and Allis Estate supply	
Windsor	314

Condition of Public Water Supplies

Samples of water have been collected regularly from the various sources of water supply throughout the State for chemical analysis and microscopical examination, and a large number of samples have been collected for bacterial examination.

The following tables show the average results of chemical analyses of samples of water collected from various sources of public water supply during the year 1940:

Analyses of the Water of Public Water Supplies—Averages of Chemical Analyses of Surface-Water Sources for the Year 1940

City or Town	Source	(Parts per Million) Color	Residue on Evaporation	Ammonia: Free	Ammonia: Total Albuminoid	Nitrogen as Nitrates	Chlorides	Hardness	Alkalinity	Fe	pH	No. of Samples
Metropolitan Water District	Wachusett Reservoir, upper end	28	37	.025	.103	.08	2.7	16	10	.10	6.6	6
	Wachusett Reservoir, lower end	14	33	.015	.094	.08	2.5	15	10	.04	6.8	6
	Sudbury Reservoir	15	40	.015	.106	.09	2.7	17	11	.09	6.7	6
	Framingham Reservoir No. 3	15	41	.017	.095	.08	3.7	21	13	.08	6.7	6
	Ware River at Coldbrook intake	33	44	.010	.116	.06	1.9	11	10	.32	–	4
	Hopkinton Reservoir	39	42	.025	.136	.08	3.2	12	9	.12	6.3	6
	Ashland Reservoir	47	43	.018	.148	.09	4.0	15	9	.17	6.4	6
	Framingham Reservoir No. 2	72	85	.065	.185	.10	17.8	21	7	.69	5.7	6
	Lake Cochituate	18	67	.034	.148	.26	6.8	28	17	.14	6.9	5
	Chestnut Hill Reservoir	14	44	.167	.099	.10	4.2	21	13	.13	6.7	6
	Weston Reservoir	15	39	.027	.082	.12	3.3	14	11	.06	6.7	6
	Spot Pond	16	39	.101	.109	.11	3.9	18	11	.08	6.7	6
	Tap in State House	16	41	.120	.099	.11	4.1	18	11	.11	6.7	6
	Tap in Revere	18	40	.042	.089	.11	4.1	17	12	.33	6.7	6
	Tap in Quincy	14	44	.013	.060	.25	4.2	20	14	.10	6.7	6
Abington	Big Sandy Pond	7	33	.020	.106	.07	8.1	9	7	.08	6.5	4
Acushnet (Fire and Water District)	New Bedford Water Supply											
Adams (Fire District)	Bassett Brook Reservoir	2	58	.008	.069	.21	1.7	42	40	.04	7.1	4
Agawam	Springfield Water Supply (Cobble Mountain Supply)											
Amherst (Water Co.)	Atkins Pond	10	23	.024	.102	.07	1.2	5	6	.14	6.1	4
	Amethyst Brook-Intake Reservoir	30	35	.012	.099	.09	1.3	11	8	.08	6.2	4
Andover	Haggett's Pond	15	49	.033	.142	.09	5.3	23	13	.04	6.7	4
Arlington	Metropolitan Water Supply											
Ashburnham	Upper Naukeag Lake	6	23	.009	.045	.08	2.0	7	5	.07	5.6	4
Ashfield (Water Co.)	Highland Spring Reservoir	24	51	.009	.079	.10	1.2	32	27	.08	6.9	3
Athol	Buckman Brook Reservoir (Newton Reservoir)	24	32	.018	.134	.08	1.6	10	7	.09	6.2	6
	Thousand Acre Meadow Brook	142	61	.019	.253	.14	1.9	17	8	.18	5.4	6
	Phillipston Reservoir	39	42	.051	.185	.09	3.8	16	8	.19	6.3	6
	Raw water at filter plant	54	43	.036	.154	.09	2.4	13	8	.33	5.7	6
	Final effluent	4	96	.020	.041	.12	2.6	29	41	.04	8.6	6
Barre	Reservoir	7	45	.015	.056	.15	3.0	17	12	.11	6.2	4
Belmont	Metropolitan Water Supply											
Beverly	Joint supply with Salem											
Blandford (Fire District)	Freeland Brook	5	32	.004	.012	.19	1.7	15	14	.05	6.8	3
Boston	Metropolitan Water Supply											

Averages of Chemical Analyses of Surface-Water Sources, etc.—Continued

City or Town	Source	Color (Parts per Million)	Residue on Evaporation	Ammonia: Free	Ammonia: Total Albuminoid	Nitrogen as Nitrates	Chlorides	Hardness	Alkalinity	Fe	pH	No. of Samples
Braintree	Great Pond (raw water)	31	59	.049	.173	.23	8.2	20	10	.16	6.6	6
	Great Pond, filtered	3	81	.057	.076	.26	8.4	32	18	.05	7.5	6
BROCKTON	Silver Lake	9	31	.008	.077	.07	6.1	9	8	.05	6.5	4
Brookfield	Cooley Hill Reservoir	15	41	.063	.142	.10	2.4	15	6	.19	6.0	4
CAMBRIDGE	Upper Hobbs Brook Reservoir	24	59	.042	.173	.15	5.2	28	14	.10	6.6	4
	Lower Hobbs Brook Reservoir	15	58	.034	.144	.12	5.0	28	13	.06	6.8	4
	Stony Brook Reservoir	41	65	.051	.188	.16	5.4	29	19	.13	6.8	4
	Fresh Pond	13	87	.030	.132	.45	8.3	40	25	.06	7.0	5
	Filter effluent	5	83	.056	.058	.42	6.9	44	25	.05	8.0	4
CHELSEA	Metropolitan Water Supply											
Cheshire (Water Co.)	Kitchen Brook Reservoir	0	54	.008	.019	.08	1.1	39	36	.03	7.3	2
Chester	Austin Brook Reservoir	9	33	.015	.046	.07	1.2	17	11	.07	6.5	2
	Horn Pond	15	34	.016	.155	.06	1.1	12	10	.05	6.5	2
CHICOPEE	Cooley Brook Reservoir, raw water	31	51	.024	.099	.08	2.2	19	14	.16	6.5	6
	Cooley Brook Reservoir, filtered	1	62	.019	.024	.85	2.7	31	18	.05	7.5	6
	Morton Brook	7	70	.010	.032	3.0	4.0	24	11	.30	6.6	6
Clinton	Lower Lynde's Reservoir	13	35	.016	.103	.08	1.9	13	11	.12	6.8	2
	Heywood Pond	16	27	.018	.145	.08	1.9	12	6	.10	6.5	4
	Spring Basin	12	53	.028	.090	.23	2.8	24	20	.04	6.9	4
Colrain (Griswoldville)	McClellan Brook Reservoir	6	83	.008	.014	.06	2.0	49	44	.11	7.3	2
Colrain (Fire District No. 1)	Mountain Brook Reservoir	7	77	.002	.017	.05	1.2	55	49	.09	7.3	2
Concord	Nagog Pond	5	32	.018	.106	.07	3.9	11	8	.04	6.4	4
Dalton (Fire District)	Egypt Brook Reservoir	26	34	.007	.064	.12	1.0	13	10	.12	6.5	4
	Raw water	22	40	.005	.067	.08	1.1	16	14	.09	6.7	4
	Filtered water	23	57	.005	.058	.08	1.0	31	29	.05	8.0	4
	Windsor Reservoir	22	54	.007	.080	.07	1.1	29	26	.16	7.0	4
Danvers	Middleton Pond	46	42	.038	.204	.09	4.6	18	11	.18	6.5	6
Dartmouth	New Bedford Water Supply											
Deerfield (South Deerfield Water Supply District)	Roaring Brook Reservoir	9	58	.008	.049	.15	1.3	40	34	.46	7.1	3
East Bridgewater	Brockton Water Supply											
East Longmeadow	Springfield Water Supply (Cobble Mountain Supply)											
Egremont (South Egremont Water Co.)	Goodale Brook Reservoir	5	42	.007	.017	.28	1.2	27	26	.07	7.1	2
Erving (Millers Falls Fire and Water District)	Montague (Turners Falls Fire District) Water supply											

EVERETT	Metropolitan Water Supply											
FALL RIVER	North Watuppa Lake	8	32	.012	.132	.05	5.8	11	4	.08	6.1	6
Falmouth	Long Pond, before lime treatment	2	39	.006	.069	.15	10.5	8	7	.04	6.4	4
	Long Pond, treated	15	40	.003	.065	.07	9.8	16	13	.29	8.5	4
FITCHBURG	Ashby Reservoir	26	29	.084	.105	.10	1.7	9	6	.42	5.9	5
	Scott Reservoir	9	29	.071	.114	.09	1.7	7	6	.11	6.2	3
	Meetinghouse Pond	9	27	.016	.105	.08	1.8	9	7	.03	6.4	4
	Wachusett Lake	9	27	.040	.280	.07	2.0	8	8	.19	6.4	4
	Falulah Brook	19	32	.025	.134	.10	1.8	10	5	.25	5.9	4
	Lovell Reservoir	14	29	.036	.158	.10	1.8	6	6	.21	6.1	4
GARDNER	Crystal Lake	11	47	.022	.145	.09	2.3	21	16	.11	6.8	4
GLOUCESTER	Haskell Reservoir	12	38	.019	.072	.07	8.7	6	3	.22	5.6	5
	Dike's Brook Reservoir	22	41	.027	.096	.07	9.4	8	4	.43	5.6	5
	Wallace Reservoir	17	41	.028	.108	.07	10.8	7	5	.23	5.9	5
	Babson Reservoir	45	59	.017	.151	.07	12.0	15	6	.32	5.9	5
Great Barrington (Housatonic Water Works Co.)	Long Pond, raw water	8	81	.019	.122	.08	1.1	72	62	.06	7.4	6
	Long Pond filtered	4	94	.012	.088	.10	1.1	80	71	.04	7.4	6
Great Barrington (Fire District)	East Mountain Reservoir	7	51	.007	.055	.07	1.3	38	33	.05	7.3	4
Greenfield	Filter Plant, raw water	8	62	.017	.061	.12	1.9	39	36	.05	7.1	6
	Filter Plant, outlet of filter	4	59	.008	.030	.13	1.7	38	36	.03	7.2	6
Groveland	Haverhill Water Supply (Johnson's Pond)											
Hadley (Water Supply District)	Hart's Brook Reservoir	4	42	.005	.038	.04	1.7	21	16	.10	7.0	3
Hanson	Brockton Water Supply											
Hatfield	Running Gutter Brook Reservoir	4	72	.005	.024	2.4	2.0	34	22	.07	7.2	3
HAVERHILL	Millvale Reservoir	62	56	.018	.220	.08	3.9	22	15	.19	6.7	5
	Johnson's Pond	19	57	.027	.171	.07	4.2	27	23	.08	6.9	5
	Crystal Lake	17	36	.020	.169	.07	3.2	16	12	.05	6.6	5
	Pentucket Lake (Round Pond)	6	43	.014	.151	.06	4.0	21	16	.07	7.0	5
	Kenoza Lake	20	49	.015	.142	.07	4.0	23	17	.08	6.9	5
Hingham (Water Co.)	Accord Pond	19	36	.009	.090	.08	6.1	8	5	.10	6.1	6
Hinsdale (Fire District)	Reservoir	7	19	.009	.047	.08	1.1	5	5	.18	5.5	3
Holbrook	Joint supply with Randolph											
Holden	Rutland Water Supply											
HOLYOKE	Hugh McLean Reservoir	5	28	.023	.084	.08	1.3	14	10	.07	6.6	6
	Carmody Reservoir	20	29	.028	.104	.08	1.3	12	9	.14	6.4	6
	Wright and Ashley ponds	10	44	.017	.098	.07	1.4	24	20	.12	7.0	6
	White Reservoir	19	38	.047	.098	.07	1.3	18	14	.17	6.7	6
	Whiting Street Reservoir	5	44	.019	.099	.09	1.4	25	20	.07	6.9	6
Hopedale	Milford Water Supply											
Hudson	Gates Pond	8	32	.024	.099	.06	2.4	15	10	.08	6.6	4
Hull	Hingham Water Supply											
Huntington (Fire District)	Cold Brook Reservoir	8	38	.005	.025	.23	1.9	18	11	.07	6.4	3
Ipswich	Dow's Brook Reservoir	29	59	.032	.188	.08	7.7	23	16	.10	6.9	4
	Bull Brook Reservoir	77	72	.023	.190	.10	7.6	28	24	.17	6.8	4
Lancaster	Clinton Water Supply											
LAWRENCE	Merrimack River	41	74	.207	.263	.103	3.9	18	9	.43	6.5	12
	Merrimack River, filtered	12	74	.146	.091	.233	5.6	32	11	.19	6.7	12
Lee (Berkshire Water Co.)	Codding Brook Upper Reservoir	10	40	.003	.033	.08	1.1	24	19	.05	7.0	3
	Codding Brook Lower Reservoir	8	42	.001	.015	.07	1.0	24	19	.05	7.1	3
	Basin Pond Brook	36	47	.002	.080	.11	1.1	21	16	.10	6.9	3

Averages of Chemical Analysis of Surface-Water Sources, etc.—Continued

City or Town	Source	Color	Residue on Evaporation	Ammonia: Free	Ammonia: Total Albuminoid	Nitrogen as Nitrates	Chlorides	Hardness	Alkalinity	Fe	pH	No. of Samples
		(Parts per Million)										
Lenox (Water Co.)	Lower Root Reservoir	4	81	.012	.040	.08	1.3	66	62	.05	7.4	4
	Woolsey Reservoir	4	62	.012	.022	.07	1.2	42	38	.04	7.1	4
Leominster	Fall Brook Reservoir	7	26	.029	.100	.07	1.7	5	5	.06	6.1	5
	Haynes Reservoir	12	25	.059	.165	.07	1.5	5	5	.12	5.8	5
	Morse Reservoir	10	24	.044	.104	.06	1.5	5	5	.11	5.9	5
	No-Town Reservoir	23	27	.034	.139	.07	1.6	7	4	.22	5.6	5
	No-Town Reservoir and Simonds Pond, filtered	4	40	.029	.053	.06	1.8	26	14	.06	8.7	5
Lexington	Metropolitan Water Supply											
Lincoln	Sandy Pond	4	27	.022	.087	.06	3.4	13	5	.10	6.3	3
Longmeadow	Springfield Water Supply (Cobble Mountain Supply)											
Ludlow	Springfield Water Supply (Ludlow Reservoir Supply)											
Lynn	Breeds Pond	24	65	.051	.166	.13	9.2	27	15	.15	6.8	4
	Birch Pond	6	47	.024	.114	.10	7.5	16	11	.09	6.5	4
	Hawkes Pond	66	78	.077	.307	.10	6.7	36	26	.26	6.8	4
	Walden Pond	36	66	.048	.173	.12	8.1	27	16	.17	6.9	4
Lynnfield (Water District)	Lynn Water Supply											
Malden	Metropolitan Water Supply											
Manchester	Gravel Pond	17	46	.008	.075	.06	8.8	11	13	.29	7.2	4
Marlborough	Lake Williams	7	55	.032	.159	.10	6.6	26	19	.06	7.0	4
	Millham Brook Reservoir	42	51	.040	.155	.21	4.1	22	13	.38	4.7	4
Maynard	White Pond	2	22	.014	.071	.07	2.2	8	6	.05	6.2	5
Medford	Metropolitan Water Supply											
Melrose	Metropolitan Water Supply											
Middleton	Joint supply with Danvers											
Milford (Water Co.)	Charles River, inlet to filters	28	39	.016	.134	.13	3.1	14	8	.16	6.2	4
	Dug Wells and Charles River, filtered	19	59	.040	.042	.20	3.6	30	22	.17	7.8	4
Milton	Metropolitan Water Supply											
Monroe (Water District)	Phelps Brook Reservoir	8	28	.004	.035	.08	1.3	17	9	.07	6.5	4
Montague (Turners Falls Fire District)	Lake Pleasant	6	28	.010	.067	.06	1.7	11	7	.09	6.5	4
Monterey (Water Co.)	Reservoir	3	84	.003	.019	.06	1.4	60	68	.08	7.2	3
Nahant	Metropolitan Water Supply											
New Bedford	Great Quittacas Pond	34	38	.015	.164	.08	5.5	9	7	.08	6.3	5
	Little Quittacas Pond	23	38	.012	.129	.07	5.5	12	8	.14	6.4	10

NEWBURYPORT	Artichoke River	29	65	.102	.306	.08	6.2	27	17	.25	6.7	4
	Collecting Basin	14	72	.050	.105	.33	6.7	28	18	.24	6.7	4
	Mixed raw water	13	69	.017	.100	.34	6.5	29	18	.24	6.7	4
	Ground and Reservoir water, filtered	7	65	.007	.069	.46	6.6	29	20	.05	6.6	4
NORTH ADAMS	Broad Brook	12	38	.016	.086	.09	1.0	20	15	.04	6.9	5
	Notch Brook Reservoir	5	74	.022	.039	.10	1.1	72	60	.06	7.4	5
	Mount Williams Reservoir	2	66	.011	.058	.07	1.2	52	48	.04	7.5	5
NORTHAMPTON	Middle Reservoir (Roberts Meadow Brook)	18	45	.010	.084	.07	1.5	22	19	.16	6.9	5
	Mountain Street Reservoir	6	42	.010	.076	.05	1.3	24	18	.04	7.0	5
North Andover	Great Pond	16	52	.016	.138	.17	4.7	22	11	.11	6.6	5
Northborough	Lower Reservoir (Cold Harbor Brook)											
	Raw Water	57	51	.010	.193	.07	3.4	18	15	.42	6.2	3
	Final Effluent	3	73	.008	.038	.08	3.0	14	33	.04	7.3	4
North Brookfield	Doane Pond	28	36	.057	.266	.08	2.0	14	8	.31	6.2	4
	North Pond	22	37	.046	.377	.07	1.9	11	8	.24	6.3	4
Northfield (Water Co.)	Minot Brook Reservoir	13	30	.004	.025	.04	1.2	16	10	.04	6.6	2
Northfield (Northfield Schools, Inc.)	Upper Reservoir on Louisiana Brook	7	34	.003	.059	.04	1.2	20	11	.25	6.7	2
	Lower Reservoir on Louisiana Brook	8	33	.004	.062	.04	1.6	19	12	.25	6.5	2
Norwood	Buckmaster Pond, raw water	10	59	.028	.192	.62	6.6	22	11	.14	6.6	4
	Buckmaster Pond, filtered	8	59	.019	.056	.75	6.7	25	13	.10	6.6	4
Orange	Coolidge Brook Reservoir	23	34	.007	.058	.10	1.7	9	9	.05	6.5	3
Palmer (Fire District No. 1)	Graves Brook, Lower Reservoir	15	38	.010	.069	.07	1.6	16	13	.45	6.5	4
PEABODY	Spring Pond	12	54	.043	.148	.07	8.4	21	13	.11	6.7	6
	Suntaug Lake	23	57	.047	.182	.09	8.6	21	14	.14	6.8	6
Pembroke	Brockton Water Supply											
PITTSFIELD	Sackett Reservoir	15	61	.005	.050	.08	1.1	50	42	.05	7.3	5
	Hathaway Brook Reservoir	5	84	.005	.028	.13	1.3	78	67	.03	7.6	5
	Ashley Reservoir	12	53	.006	.053	.09	1.2	41	34	.05	7.3	5
	Ashley Lake	10	30	.035	.124	.08	1.1	17	13	.08	6.6	5
	Farnham Reservoir	41	34	.023	.136	.10	1.1	15	7	.20	6.3	5
	Mill Brook Reservoir	30	40	.016	.121	.10	1.2	19	11	.16	6.7	5
	Sand Wash Brook	86	39	.069	.312	.10	1.0	14	7	.60	5.7	5
Plainville	North Attleborough Water Supply											
Plymouth	Little South Pond	2	28	.004	.070	.05	6.9	5	5	.03	6.3	3
	Great South Pond	2	29	.004	.061	.05	6.9	4	5	.04	6.4	3
QUINCY	Metropolitan Water Supply											
Randolph	Great Pond, raw water	31	59	.052	.183	.32	7.8	20	11	.23	6.5	6
	Filtered water	25	66	.046	.155	.32	8.0	22	14	.13	6.6	6
REVERE	Metropolitan Water Supply											
Rockland	Joint supply with Abington											
Rockport	Cape Pond, raw water	29	93	.206	.228	.08	22.0	21	6	.88	5.5	5
	Filtered water	4	110	.211	.072	.10	22.3	37	16	.04	8.2	5
Russell	Black Brook Reservoir	20	31	.004	.048	.07	1.2	11	10	.19	6.5	3
	Black Brook Reservoir, filtered	10	28	.002	.020	.09	1.1	11	11	.04	6.6	3
Rutland	Muschopauge Lake	5	39	.020	.125	.08	4.1	18	8	.06	6.6	3
SALEM	Ipswich River at Pumping Sta.	47	125	.089	.217	.41	8.9	59	49	1.4	6.9	4
	Longham Reservoir	91	70	.053	.293	.10	9.4	24	13	1.0	6.3	4
	Wenham Lake	31	73	.050	.182	.12	8.8	30	20	.18	6.7	4
	Wenham Lake, filtered	2	75	.057	.085	.13	8.6	31	11	.04	6.2	4

Averages of Chemical Analyses of Surface-Water Sources, etc.—Concluded

City or Town	Source	Color	Residue on Evaporation	Ammonia: Free	Ammonia: Total Albuminoid	Nitrogen as Nitrates	Chlorides	Hardness	Alkalinity	Fe	pH	No. of Samples
		(Parts per Million)										
Saugus	Lynn Water Supply											
Shelburne (Shelburne Falls Fire District)	Fox Brook Reservoir	3	53	.004	.015	.05	1.1	41	34	.07	7.2	3
Somerville	Metropolitan Water Supply											
Southborough	Sudbury Reservoir	19	38	.018	.086	.09	3.6	18	10	.18	6.6	4
Southbridge	Hatchet Brook Reservoir No. 3	15	26	.016	.098	.07	2.0	9	7	.17	6.3	4
	Hatchet Brook Reservoir No. 4	13	29	.010	.098	.06	2.0	9	6	.18	6.3	4
	Hatchet Brook Reservoir No. 5	12	25	.016	.095	.06	2.0	7	5	.23	6.1	4
South Hadley (South Hadley Fire District No. 1)	Buttery Brook Reservoir	16	45	.051	.106	.38	3.2	23	12	.52	6.6	4
	Leaping Well Reservoir	7	31	.008	.097	.06	1.7	12	11	.10	6.6	4
South Hadley (Fire District No. 2)	Elmer Brook, raw water	6	72	.004	.052	.05	1.7	42	33	.04	7.1	3
	Elmer Brook, filtered water	3	72	.005	.023	.06	1.9	43	34	.04	7.0	3
Southwick	Springfield Water Supply (Cobble Mountain Supply)											
Spencer	Shaw Pond	6	23	.008	.078	.06	1.7	6	7	.12	6.4	4
Springfield	Cobble Mountain Reservoir	14	32	.015	.079	.08	1.3	11	8	.18	6.5	5
	Cobble Mountain Reservoir, filtered	9	32	.005	.036	.11	1.3	12	8	.06	6.1	5
	Ludlow Reservoir, unfiltered	12	34	.032	.119	.08	1.6	15	10	.10	6.6	4
	Ludlow Reservoir, filtered	6	32	.005	.078	.06	1.5	14	10	.04	6.6	2
Stockbridge (Water Co.)	Lake Averic	10	72	.012	.145	.09	1.3	53	51	.13	7.2	3
Stoneham	Metropolitan Water Supply											
Stoughton	Muddy Pond	44	45	.036	.116	.08	3.7	14	11	.14	6.2	7
Sunderland (Water Co.)	Saw Mill Brook Reservoir	3	71	.003	.010	.08	1.7	43	42	.06	7.2	3
Swampscott	Metropolitan Water Supply											
Taunton	Assawompsett Pond	28	38	.016	.204	.06	5.6	8	6	.16	6.1	5
	Elder's Pond	13	34	.013	.166	.06	6.0	10	6	.06	6.2	5
Wakefield	Crystal Lake	16	72	.067	.156	.35	8.3	29	22	.32	6.9	4
	Crystal Lake, filtered	10	69	.011	.081	.40	8.0	29	23	.11	6.8	4
Wareham (Onset Fire District)	Jonathan Pond	3	30	.011	.083	.05	6.6	6	4	.04	6.2	4
Watertown	Metropolitan Water Supply											
West Bridgewater	Brockton Water Supply											
Westfield	Montgomery Reservoir	34	33	.011	.106	.10	1.5	6	7	.14	6.3	5
	Winchell Reservoir	7	30	.007	.054	.06	1.4	10	10	.09	6.7	5
	Granville Reservoir	7	35	.015	.097	.06	1.4	6	8	.12	6.5	5
Westhampton (Water Co.)	Reservoir	6	39	.003	.019	.05	1.4	18	17	.09	6.9	3
West Newbury	Tap in Town (Groveland Supply)	15	59	.015	.118	.10	5.5	29	24	.15	6.7	3

West Springfield	Bear Hole Brook Reservoir	9	72	.010	.053	.06	1.7	47	42	.11	7.2	4
	Bear Hole Brook Reservoir, filtered	4	73	.006	.018	.06	1.6	46	42	.03	7.1	4
West Stockbridge (Water Co.)	East Mountain Reservoir	10	52	.002	.032	.05	1.6	30	16	.03	6.9	1
Weymouth	Great Pond	36	43	.015	.115	.08	6.2	11	5	.26	5.6	6
	Great Pond, filtered	6	57	.013	.052	.07	6.1	14	17	.20	7.2	6
Whitman	Brockton Water Supply											
Wilbraham	Springfield Water Supply (Ludlow Reservoir Supply)											
Williamsburg	Unquomonk Brook Reservoir	10	40	.008	.042	.07	1.5	19	17	.09	6.7	3
Williamstown (Water Co.)	Paul Brook	2	46	.004	.019	.20	1.3	36	30	.03	7.1	3
	Sherman Spring Reservoir	0	119	.003	.015	.23	1.2	96	95	.04	7.4	3
	Rattlesnake Brook Reservoir	3	87	.003	.012	.07	1.2	71	73	.03	7.6	3
Winchester	North Reservoir	6	40	.012	.106	.06	4.6	22	10	.07	6.6	10
	Middle Reservoir	11	35	.037	.230	.07	4.7	17	9	.15	6.5	11
	South Reservoir	5	36	.014	.104	.06	4.3	21	10	.05	6.7	10
Winthrop	Metropolitan Water Supply											
WORCESTER	Pine Hill Reservoir	10	30	.051	.103	.09	2.2	12	8	.14	6.5	5
	Upper Holden Reservoir	10	27	.012	.078	.08	2.1	9	7	.13	6.5	5
	Lower Holden Reservoir	8	28	.014	.080	.09	2.1	10	8	.09	6.5	5
	Leicester Reservoir (Lynde Reservoir)	14	34	.020	.112	.08	2.3	14	9	.08	6.6	5
	Bottomly Reservoir (Kettle Brook No. 4)	24	37	.025	.111	.40	2.1	17	7	.10	6.3	6
	Kent Reservoir (Kettle Brook No. 1)	18	36	.024	.096	.10	2.3	15	9	.09	6.5	5
	Mann Reservoir (Kettle Brook No. 2)	14	30	.021	.088	.10	2.0	13	8	.08	6.5	5
	Kendall Reservoir	8	28	.026	.095	.08	2.2	13	8	.14	6.5	5
	Quinapoxet Pond	33	33	.015	.126	.09	1.6	12	8	.10	6.4	5

Averages of Chemical Analyses of Ground-Water Sources for the Year 1940

City or Town	Source	Color	Residue on Evaporation	Ammonia: Free	Ammonia: Total Albu-minoid	Nitrogen as: Nitrates	Nitrogen as: Nitrites	Chlorides	Hardness	Alkalinity	Fe	Mn	pH	No. of Samples
		(Parts per Million)												
Acton (West and South Water Supply District)	Tubular wells	0	92	.005	.013	1.7	.000	5.4	40	22	.04	–	6.1	4
Amesbury	Tubular wells	29	139	.077	.040	1.1	.050	5.4	66	55	5.4	.47	6.7	4
	Tubular wells, filtered	9	128	.006	.022	.16	.001	5.4	66	52	.26	.02	7.3	4
Ashland	New tubular wells	6	59	.036	.040	.11	.000	5.5	25	18	.08	–	6.1	4
Attleboro	Dug wells and filtered water (South Attleboro)	2	69	.005	.029	.21	.000	5.1	39	32	.06	–	7.4	4
	Gravel packed wells (South Attleboro)	1	45	.002	.016	.15	.000	4.7	25	16	.05	–	5.9	4
Auburn (Water Co.)	Tubular wells	0	110	.007	.015	2.0	.000	8.4	59	40	.03	–	6.2	4
Avon	Dug and tubular wells	1	65	.002	.022	2.0	.000	6.4	29	10	.03	–	5.7	4
Ayer	Dug well	1	94	.004	.008	4.1	.000	8.7	40	20	.07	–	6.2	4
	Tubular wells	6	77	.010	.013	.18	.001	5.4	46	42	.71	–	6.5	4
Barnstable (Water Co.)	Tubular wells (old supply)	6	45	.014	.010	.08	.000	11.2	13	9	.25	–	5.6	4
(Fire District)	Tap in town (Yarmouth Water Supply)	3	46	.004	.009	.08	.000	13.8	8	7	.07	–	5.8	4
(Cotuit Fire District)	Gravel-packed wells	4	35	.008	.012	.10	.000	10.0	7	5	.11	–	5.4	4
(Centreville-Osterville Fire District)	Tubular wells	6	40	.003	.006	.23	.000	9.7	6	6	.22	–	5.8	4
(Centreville-Osterville Fire District)	Gravel-packed wells	1	40	.008	.010	.38	.000	9.8	7	5	.04	–	5.7	4
Bedford	Dug well	3	39	.005	.026	.16	.000	4.5	14	11	.09	–	6.1	4
	Tubular wells	2	44	.005	.018	.25	.000	4.2	18	14	.25	–	6.0	4
Belchertown (Water District)	Tubular wells	0	87	.004	.009	.76	.000	5.2	33	21	.04	–	6.2	4
Bellingham	Gravel-packed well No. 1	1	46	.004	.006	.37	.000	3.4	19	16	.04	–	6.5	3
	Gravel-packed well No. 2	3	46	.003	.006	.14	.000	3.3	21	21	.04	–	6.5	3
Bernardston (Fire and Water District)	Dug well	0	22	.002	.004	.15	.000	1.6	16	11	.04	–	6.4	4
Billerica	Gravel-packed wells	34	87	.155	.082	.15	.001	9.6	30	21	.59	.46	6.4	4
Bourne														
(Bourne Water District)	Gravel packed wells	1	38	.003	.006	.08	.000	7.4	7	9	.05	–	6.0	11
(Buzzards Bay Water District)	Tubular wells	1	35	.005	.010	.08	.000	7.6	6	7	.04	–	5.8	4
(Sagamore—Ware Tenement Supply)	Tubular wells	0	58	.005	.006	1.5	.000	9.9	16	9	.11	–	5.9	2
(Sagamore—Keith Block)	Tubular wells	1	69	.011	.011	1.5	.000	10.7	23	16	.19	–	5.9	2
(Sagamore—Knowlton Property)	Tubular wells	0	47	.004	.004	.13	.000	8.2	10	11	.13	–	6.4	2
(Sagamore—Savery Supply)	Tubular wells	1	52	.011	.011	.28	.000	10.3	10	11	.05	–	5.9	2

(Sagamore Beach)	Tubular wells	1	65	.002	.004	.26	.000	17.5	14	8	.04	–	5.8	2
(Sagamore Heights)	Tubular wells	7	51	.007	.008	.14	.000	13.6	12	8	.49	–	6.0	2
Bridgewater	Tubular wells	0	56	.005	.009	2.2	.000	6.5	20	10	.05	–	5.9	4
Brookline	Tubular wells, gravel-packed wells and filter gallery, raw water	55	108	.080	.064	.48	.004	8.7	50	44	1.32	.42	6.5	6
	Tubular wells, gravel-packed wells and filter gallery, filtered	15	103	.005	.048	.45	.001	8.5	47	41	.14	.03	7.0	6
Canton	Henry's Spring well	3	67	.004	.020	.90	.000	7.4	28	11	.03	–	5.9	4
	Ward well	18	88	.010	.048	.68	.000	6.6	26	35	.07	–	6.6	4
	Springdale well	3	55	.003	.016	.31	.000	5.3	23	15	.04	–	6.1	4
Chatham (Water Co.)	Tubular wells	0	39	.003	.005	.08	.000	13.0	8	6	.03	–	5.6	3
Chelmsford (North Chelmsford Fire District)	Tubular wells	24	50	.166	.070	.30	.002	4.5	25	22	.54	–	6.3	4
(Water District)	Tubular wells	3	80	.011	.019	2.1	.002	6.0	44	22	.14	–	6.2	4
Cohasset (Water Co.)	Raw water at filter plant	83	85	.048	.129	.17	.001	12.2	28	14	1.5	.28	5.7	4
	Filtered water	7	115	.055	.048	.16	.001	13.1	56	26	.08	.21	8.3	4
Colrain (Griswoldville)	Deep tubular well	1	86	.001	.004	.46	.000	2.9	50	45	.09	–	6.9	2
	Spring	3	66	.002	.004	.08	.000	1.2	39	34	.43	–	6.7	2
Colrain (Lyonsville)	Deep tubular well	1	128	.002	.005	.08	.000	2.0	79	81	.03	–	7.7	2
Cummington	Springs	0	55	.002	.028	1.46	.000	3.1	23	16	.04	–	6.2	2
Dedham (Water Co.)	Dug and tubular wells (Dedham)	12	99	.034	.034	.76	.000	9.6	41	31	.21	–	6.3	4
Deerfield (Fire District)	North Springs	2	50	.005	.007	.10	.000	3.5	26	18	.03	–	6.3	3
	Harris Springs	1	57	.005	.009	1.5	.000	2.2	30	17	.04	–	6.6	3
	South Springs	3	43	.003	.019	.33	.000	1.5	17	12	.15	–	6.5	3
Douglas	Tubular wells	0	55	.004	.015	.70	.000	3.8	24	16	.04	–	6.1	4
Dover	Tubular wells	1	98	.012	.004	1.5	.005	11.0	46	32	.10	–	6.5	2
Dracut (Water Supply District)	Tubular wells, Dracut	9	127	.009	.028	2.7	.001	8.5	61	39	.19	.05	6.5	3
	Tubular wells, Lakeview	37	114	.145	.056	.25	.001	4.8	94	90	1.2	.35	6.6	2
Dudley	Tubular wells	0	36	.003	.008	.18	.000	3.5	17	13	.04	–	5.9	3
Dunstable	Tubular wells	2	54	.006	.016	.70	.000	2.4	22	17	.17	–	6.2	3
Duxbury (Fire and Water District)	Tubular wells	0	51	.004	.007	.14	.000	10.0	13	11	.03	–	6.0	3
East Brookfield	Well	1	29	.003	.011	.16	.000	2.4	12	9	.06	–	5.8	3
Easthampton	Tubular wells	0	82	.009	.013	.48	.000	2.2	45	45	.03	–	7.6	3
Easton (North Easton Village District)	Dug well	3	50	.003	.024	.75	.000	5.3	21	10	.08	–	5.7	6
Easton (Unionville Fire and Water District)	North Easton Village District Water Supply													
Edgartown (Water Co.)	Dug and tubular wells	0	35	.003	.012	.11	.000	9.3	5	5	.03	–	5.6	4
Fairhaven (Water Co.)	Tubular wells near Nasketucket River	29	71	.023	.069	.47	.000	10.6	30	15	.30	–	5.6	6
	Tubular wells near Mattapoisett River	0	94	.003	.016	.98	.000	22.8	27	11	.09	–	5.6	6
Foxborough	Tubular wells	4	53	.005	.014	.67	.000	4.3	24	16	.16	–	6.0	3
Framingham	Gravel-packed well No. 1	3	104	.052	.011	.10	.001	9.0	49	41	.19	–	7.2	4
	Gravel-packed well No. 2	7	96	.044	.018	.08	.000	6.9	44	36	.66	–	6.6	4
	Gravel-packed well No. 3	0	86	.004	.005	.66	.000	5.2	35	25	.06	–	6.6	4
Franklin	Tubular wells	8	52	.008	.012	.41	.000	4.6	19	17	.56	–	6.0	4
Georgetown	Tubular wells (raw water)	1	61	.005	.010	.18	.000	4.2	24	18	1.2	.03	6.1	4
	Tubular wells, settled coke filter effluent	1	60	.004	.012	.18	.000	4.2	26	19	.13	.02	6.6	4
	Tap in town	2	56	.005	.011	.18	.000	4.0	26	18	.10	.02	6.6	4

Averages of Chemical Analyses of Ground-Water Sources, etc.—Continued

(Parts per Million)

City or Town	Source	Color	Residue on Evaporation	Ammonia: Free	Ammonia: Total Albuminoid	Nitrogen as: Nitrates	Nitrogen as: Nitrites	Chlorides	Hardness	Alkalinity	Fe	Mn	pH	No. of Samples
Gill (Riverside Water Co.)	Spring	3	77	.002	.009	.67	.000	2.2	36	28	.07	–	6.8	2
Gosnold	Well	1	680	.002	.025	3.70	.000	266.	104	14	.06	–	5.9	3
Grafton (Water Co.)	Gravel-packed well at North Grafton	3	68	.000	.010	.50	.000	5.6	26	21	.03	–	5.9	1
	Dug wells at Grafton	6	121	.032	.024	3.20	.000	12.1	47	26	.04	–	6.1	4
(Sandersville Supply)	Springs	5	36	.003	.010	.21	.000	2.9	12	8	.38	–	6.1	4
(Fisherville Supply)	Springs and deep tubular wells	2	54	.003	.020	.63	.000	3.6	20	12	.45	–	6.2	4
Granville (Center Water Co.)	Well and springs	5	27	.006	.021	.08	.000	1.5	10	10	.05	–	6.0	2
Great Barrington (Fire District)	New infiltration gallery near Green River	3	82	.003	.016	.20	.000	1.7	55	59	.05	–	7.0	4
Greenfield	Dug well near Green River	10	56	.007	.011	.08	.000	1.7	35	33	.37	–	7.3	2
Groton (Water Co.)	Dug well	4	71	.038	.029	.13	.000	2.7	45	46	.14	–	6.7	5
Groton (West Groton Water Supply District)	Tubular wells	0	54	.005	.015	.59	.000	3.2	32	28	.05	–	6.3	3
Hamilton	Gravel-packed and tubular wells	0	84	.004	.006	.59	.000	10.9	32	25	.04	–	6.3	11
Hanover	Tubular wells	2	69	.004	.010	.49	.000	7.0	26	19	.15	–	6.0	4
Hardwick (Center)	Dug well	2	55	.002	.008	.18	.000	2.2	21	23	.65	–	6.8	3
Hardwick (Gilbertville)	Dug and tubular wells	1	66	.001	.009	.11	.000	1.9	35	31	.06	–	6.9	3
Hardwick (Wheelwright)	Tubular wells	1	66	.005	.009	.55	.000	1.9	11	10	.04	–	5.8	3
Harwich	Gravel-packed wells	1	41	.002	.007	.30	.000	13.4	12	8	.06	–	5.8	4
Hingham (Water Co.)	Filter galleries	18	85	.005	.041	.33	–	7.9	40	36	.07	–	8.0	6
Holliston (Water Co.)	Gravel-packed well	1	49	.004	.014	.54	.000	3.3	23	16	.08	–	6.4	5
Hopedale	Milford Water Supply													
Hopkinton	Tubular wells	0	68	.002	.027	1.5	.000	3.9	27	18	.04	–	6.3	3
Hull	Hingham Water Supply													
Kingston	Tubular wells	0	54	.004	.006	.11	.000	7.1	13	11	.03	–	6.2	3
Lanesborough (Village Water District)	Tubular wells	2	214	.002	.007	.30	.000	1.3	186	190	.10	–	7.4	4
Leicester (Water Supply District)	Dug wells	9	75	.016	.014	.88	.000	3.2	33	22	.08	–	6.5	3
Leicester (Cherry Valley and Rochdale Water District)	Dug wells	23	43	.050	.119	.10	.000	3.4	20	16	.13	–	6.3	3
Littleton	Tubular wells	0	36	.003	.008	.33	.000	2.5	20	13	.04	–	6.1	3
Lowell	Boulevard wells, raw water	48	71	.148	.053	.28	.000	5.0	27	21	1.9	.43	6.4	3
	Cook wells	32	97	.058	.067	.23	.001	6.7	37	32	3.5	.40	6.1	4
	Effluent of sand filter	18	58	.045	.036	.36	.001	4.4	27	20	.60	.20	6.4	4
Lynnfield	(Pitman's supply)	0	152	.000	.006	.60	.000	7.0	151	119	.05	–	7.7	1
Manchester	Dug and tubular wells	0	124	.004	.009	.84	.000	18.1	41	46	.06	–	6.5	4

Mansfield	Dug well	0	40	.006	.011	.26	.000	3.8	16	10	.07	–	5.9	4
Marblehead	Tubular wells	44	204	.060	.142	.26	.005	11.1	118	95	.33	.39	7.0	4
	Dug well	6	168	.030	.027	.16	.000	15.9	83	42	.80	.28	6.8	4
	Dug and tubular wells, filtered	6	154	.004	.029	.20	.000	15.3	87	43	.14	.02	7.1	4
Marion	Old tubular wells	2	44	.002	.006	.27	.000	7.6	15	9	.03	.01	5.7	4
	New tubular wells	2	110	.004	.012	.22	.000	23.0	43	30	.10	–	6.5	1
Marshfield Main Supply	Tubular wells	0	46	.002	.004	.14	.000	8.5	9	13	.04	–	6.2	4
Parsonage Street Wells	Tubular wells	1	94	.001	.011	1.11	.000	20.	34	14	.08	–	5.8	4
Brant Rock Wells	Dug wells	0	97	.000	.006	.58	.000	23.	20	10	.09	–	6.0	2
Humarock Beach Wells	Tubular wells	2	84	.002	.009	.32	.000	20.1	20	13	.42	–	5.7	4
Mattapoisett	Tubular wells	5	64	.005	.010	.68	.000	8.5	26	18	.24	–	5.9	2
Medfield	Tubular wells, tap in town (supplied from State Hospital)	1	80	.004	.012	.22	.000	4.2	40	37	.05	–	7.2	8
Medway	Tubular wells	6	85	.050	.018	1.0	.000	9.0	34	28	.32	–	6.3	4
Merrimac	Tubular wells	1	66	.007	.013	.22	.000	6.0	30	16	.13	–	5.9	3
Methuen	Gravel-packed well	24	93	.044	.039	1.05	.000	8.1	37	21	.95	.48	6.1	3
	Lone Tree Hill wells	17	89	.326	.050	.39	.000	6.9	47	46	.64	2.7	6.6	4
Middleborough	Dug well	43	72	.122	.044	.72	.000	7.0	25	22	2.9	.71	6.0	4
	Final effluent (dug well filtered)	8	65	.002	.015	.78	.000	7.1	25	18	.14	.02	6.6	4
Milford	Wells													
(Milford Water Co.)	Outlets of filter	19	59	.040	.042	.20	.000	3.6	30	22	.17	–	7.8	4
Millbury (Water Co.)	Dug well	1	49	.001	.015	.49	.000	4.7	25	15	.04	–	5.8	3
Millis	Dug wells	2	129	.002	.009	3.9	.000	10.5	64	35	.08	–	6.6	5
Monson	Old dug well	19	36	.005	.025	.13	.000	1.8	13	11	.06	–	6.5	4
	New dug well	0	29	.013	.014	.12	.000	1.9	10	11	.03	–	6.3	4
Montague (Montague Village)	Springs	8	54	.007	.058	.23	.001	2.0	23	20	.22	–	6.8	3
Nantucket (Wannacomet Water Company)	Dug and tubular wells at Wyers Valley	0	61	.004	.022	.19	.000	17.5	21	14	.03	–	6.3	4
Nantucket (Siasconset)	Dug wells	1	60	.002	.007	.12	.000	15.7	19	15	.03	–	6.2	3
Natick	Dug well	1	116	.004	.015	.72	.000	10.7	57	45	.04	–	6.8	4
Needham	Dug well No. 1	1	101	.003	.017	4.0	.000	8.3	37	15	.03	–	5.8	4
	Dug well No. 2	0	89	.002	.006	3.8	.000	7.6	38	17	.04	–	5.9	4
	Tubular wells (Great Plain Avenue)	4	109	.002	.007	1.0	.001	7.5	47	51	.20	–	6.8	3
	Gravel-packed well (Charles River Street)	1	109	.004	.006	1.5	.000	7.0	55	47	.07	–	7.1	4
Newton	Tap in pumping station (treated water)	4	138	.067	.022	.42	.001	8.2	33	83	.09	–	7.5	5
	Dug well No. 1	1	81	.003	.016	.66	.000	6.6	39	32	.04	–	6.3	5
	Dug well No. 2	1	79	.003	.024	.29	.000	6.9	37	34	.04	–	6.3	5
	Dug well No. 3	2	72	.003	.025	.34	.000	7.8	34	28	.04	–	6.3	5
	Dug well No. 4	1	91	.002	.019	.27	.000	7.1	45	37	.03	–	6.3	5
North Attleborough	Dug wells	12	108	.007	.026	.27	.001	5.6	60	56	1.0	–	7.6	3
Northbridge	Tubular wells (Meadow Pond)	1	37	.006	.011	.29	.000	3.9	16	14	.04	–	5.8	2
	Tubular wells (Cook Allen)	0	28	.006	.010	.20	.000	2.6	8	7	.03	–	5.7	2
North Reading	Tap in town (Wilmington Supply)	0	62	.002	.009	.34	.000	4.5	27	22	.11	–	6.4	3
Norton	Tubular wells	2	51	.008	.010	.82	.001	4.2	19	14	.18	–	6.1	4
Norwood	Tubular wells													
	Raw water	2	96	.010	.019	.75	.000	8.4	42	25	.17	.04	6.5	4
	Final effluent	0	84	.008	.010	.72	.000	8.5	43	25	.04	.02	6.6	4
Oak Bluffs (Cottage City Water Co.)	Springs	1	41	.004	.006	.26	.000	9.2	11	10	.27	–	6.2	3

Averages of Chemical Analyses of Ground-Water Sources, etc.—Continued

(Parts per Million)

City or Town	Source	Color	Residue on Evaporation	Ammonia: Free	Ammonia: Total Albuminoid	Nitrogen as Nitrates	Nitrogen as Nitrites	Chlorides	Hardness	Alkalinity	Fe	Mn	pH	No. of Samples
Orange	Crystal Spring	7	34	.055	.082	.08	–	1.7	10	10	.09	–	6.3	3
Oxford (Water Co.)	Tubular wells	0	49	.003	.007	.45	.000	3.7	23	16	.03	–	6.1	3
Palmer (Three Rivers)	Cheney Supply collecting wells	0	42	.004	.015	.05	.000	2.0	15	16	.03	–	6.6	2
(Bondsville Water Co.)	Tubular wells	0	47	.004	.008	.39	.000	3.5	30	19	.10	–	6.2	3
(Thorndike)	Hamilton Reservoir	9	40	.009	.035	.06	–	2.1	15	15	.07	–	6.6	3
Paxton	Spring	3	25	.001	.014	.08	.000	1.9	14	12	.24	–	6.5	3
Pepperell	Tubular wells	5	32	.003	.014	.11	.000	2.5	14	12	.22	–	6.1	3
Provincetown	Tubular wells	1	187	.008	.008	.08	.000	79.1	44	11	.05	–	6.2	7
Reading	New Tubular wells	16	107	.024	.035	.40	.001	9.2	50	28	1.0	.18	6.1	4
	New Tubular wells, filtered	6	102	.002	.031	.38	.000	9.6	47	28	.17	.03	7.1	4
Rockport	Tubular wells	1	102	.003	.010	.52	.000	15.0	43	38	.05	–	8.4	4
Salisbury (Water Supply Company)	New dug well and gravel-packed well	10	97	.004	.006	.09	.000	6.9	51	51	.76	–	7.0	4
Scituate	Webster Meadow wells	1	112	.002	.007	1.0	.000	18.9	43	25	.05	–	6.4	8
	Beaver Dam wells	1	150	.004	.009	2.3	.000	25.7	56	27	.05	–	6.4	4
	Kent Street wells	3	289	.004	.006	.45	.000	101.	93	20	.03	–	6.4	1
Sharon	Dug well and tubular wells	2	181	.004	.009	5.5	.000	26.8	85	52	.04	–	6.6	4
	Tubular wells	2	70	.006	.018	1.2	.000	7.1	26	22	.22	–	6.3	4
Sheffield (Water Co.)	Smith Spring	1	34	.003	.008	.12	.000	1.4	20	19	.03	–	6.1	3
	Farm House Spring	1	38	.004	.011	.15	.000	1.4	22	22	.04	–	6.3	3
	Red Rock Spring	1	29	.007	.007	.14	.000	1.3	15	13	.08	–	6.0	3
Shirley (Shirley Village Water District)	Dug wells	3	65	.005	.005	3.5	.000	6.7	27	12	.13	–	6.2	3
Shrewsbury	Gravel-packed wells (South Street)	5	66	.072	.025	.67	.025	4.7	26	19	.26	–	6.1	3
	Gravel-packed wells (Oak Street)	0	63	.004	.021	.40	.000	4.5	25	18	.04	–	6.0	3
Somerset	Tubular wells	29	152	.007	.041	.25	.001	6.7	26	79	.65	–	7.5	3
South Hadley (Fire District No. 2)	Dug wells	1	58	.004	.018	.17	.000	3.2	31	23	.06	–	6.7	3
Sterling	Tubular wells	1	62	.006	.012	.47	.000	3.6	33	28	.08	–	6.3	4
Stockbridge (Hill Water Co.)	Springs	1	62	.002	.011	.07	.000	1.5	44	43	.04	–	7.2	3
Stoughton	Collecting well system	2	35	.008	.014	.10	.000	3.7	11	9	.05	–	5.8	5
Sturbridge	Tubular wells	6	59	.004	.006	.34	.000	5.4	22	20	.88	–	6.3	4
Sudbury	Tubular wells	3	57	.002	.005	.27	.000	3.8	29	26	.09	–	6.9	3
Sutton (Water Co.)	Dug and tubular wells	3	110	.004	.013	1.1	.000	4.5	59	42	.20	–	7.0	3
Tisbury	Tashmoo Spring	0	47	.003	.011	.08	.000	10.5	7	9	.04	–	6.0	4
Topsfield (Topsfield Water Co., Inc.)	Dug and tubular wells	1	187	.009	.009	1.04	.000	11.9	116	103	.05	–	7.3	4
Townsend	Tubular wells	0	29	.002	.008	.20	.000	1.9	7	9	.04	–	5.6	4

Upton (West Upton) (William Knowlton and Sons Company)	Tubular wells	1	75	.005	.010	.76	.000	5.9	29	15	.09	–	5.9	4
Uxbridge	Tubular wells, new system	1	57	.013	.019	.87	.000	5.5	27	16	.06	–	5.9	4
	Springs, old system	1	32	.003	.006	.08	.000	2.4	11	10	.06	–	6.6	2
Wakefield	Tubular wells	2	138	.004	.011	2.1	.000	18.3	56	23	.35	–	6.3	2
Walpole	Tubular wells	1	61	.003	.011	.80	.000	4.9	24	19	.03	–	6.2	3
Waltham	Old dug well	8	103	.062	.026	.18	.000	8.6	44	44	1.35	–	6.4	5
	New dug well	0	75	.004	.014	.40	.000	6.7	37	27	.04	–	6.3	5
Ware	Large well, treated	0	71	.004	.007	1.4	.000	4.0	28	20	.03	–	6.1	4
Wareham (Wareham Fire District)	Tubular wells	3	32	.003	.010	.07	.000	6.3	12	8	.07	–	5.6	5
Warren (Warren Water District)	Tubular wells	1	42	.003	.007	.33	.000	2.7	13	12	.04	–	6.0	4
(West Warren Water Co.)	Dug wells	12	48	.003	.022	1.85	.000	1.9	22	13	.11	–	5.7	3
Wayland	Gravel-packed and tubular wells	2	103	.005	.009	.74	.000	6.8	46	31	.21	–	6.6	5
Webster	Tubular wells	0	43	.009	.009	.33	.000	3.7	20	18	.06	–	6.2	4
Wellesley	Tubular wells at pumping station No. 1	1	93	.008	.012	1.0	.000	7.6	42	32	.04	–	6.4	3
	Dug well at pumping station No. 2	1	81	.003	.016	1.0	.000	6.5	34	26	.03	–	6.3	3
	Large tubular well at pumping station No. 3	2	81	.003	.010	.74	.000	5.6	37	22	.21	–	6.2	3
	Gravel-packed well at pumping station No. 4	1	85	.005	.017	.34	.000	5.9	39	33	.04	–	6.7	3
Westborough	Filter basin	5	29	.014	.066	.06	–	2.8	12	8	.06	–	6.6	4
West Brookfield	Tubular wells	1	52	.005	.017	.14	.000	3.0	16	7	.13	–	5.7	3
Westford (Water Co,)	Tubular wells	1	52	.008	.007	.07	.000	2.4	22	24	.05	–	6.7	4
(Abbot Worsted Co.)	Tubular wells	1	85	.004	.009	.65	.000	3.5	36	26	.03	–	6.4	3
Weston	Tubular wells at Warren Avenue	2	103	.004	.013	2.5	.000	7.9	49	26	.08	–	6.2	4
	Tubular wells at Kendal Green	1	68	.004	.011	.80	.000	6.2	32	22	.12	–	6.2	4
(Keewaydin Water Works)	Dug well	2	73	.004	.012	.64	.000	4.9	29	18	.05	–	5.9	4
(Water Co.)	Dug well A	1	63	.022	.036	.18	.000	4.6	33	20	.03	–	6.0	1
	Dug well C	3	74	.012	.024	.43	.000	5.3	34	20	.12	–	6.0	2
(Glen Farms Water Co.)	Dug well	0	97	.006	.015	3.5	.000	6.0	43	22	.10	–	6.4	2
West Stockbridge (Water Co.)	Johnson's Spring	0	130	.002	.022	.21	.000	1.2	90	97	.03	–	7.1	1
	Blake's Spring	2	140	.002	.026	.20	.000	1.0	123	118	.03	–	7.5	1
Westwood	Dedham Water Supply													
(Water Co.)	Tubular wells	4	82	.004	.020	1.7	.000	7.4	36	22	.22	–	6.1	4
Whately (Craft Supply)	Springs	2	142	.007	.008	8.0	.000	8.6	77	68	.09	–	6.8	2
Williamstown (Water Co.)	Cold Spring	1	134	.001	.005	2.8	–	1.1	135	125	.04	–	7.5	3
Wilmington	Tubular wells	2	64	.003	.006	.34	.000	4.4	27	22	.06	–	6.3	4
Winchendon	New dug well	10	28	.026	.032	.11	.001	1.8	9	7	.11	–	5.4	5
	Old dug well	13	44	.054	.037	.11	.001	2.1	16	11	.40	–	5.6	5
Winchester	Pond Street wells	1	200	.005	.018	1.5	.000	31.9	95	55	.05	–	6.6	4
Woburn	Gravel-packed well A	5	105	.006	.038	.38	.000	10.1	52	38	.13	–	6.7	4
	Gravel-packed well A2	1	119	.032	.026	.40	.000	10.2	57	51	.04	–	6.9	4
	Gravel-packed well B	1	104	.011	.030	.23	.000	9.7	50	37	.03	–	6.6	3
	Gravel-packed well D	1	80	.005	.018	.23	.000	7.6	39	24	.03	–	6.3	4
	Gravel-packed well E	1	114	.002	.015	3.3	.000	10.2	51	23	.04	–	6.2	4
Worthington (Fire District)	Springs	5	23	.002	.024	.08	.000	1.2	10	13	.10	–	6.1	1
Wrentham	Large tubular wells	0	65	.002	.011	2.5	.000	5.3	29	12	.05	–	6.0	3
Yarmouth	Tubular wells	0	44	.007	.009	.07	.000	13.8	13	7	.04	–	5.6	3

Comparison of Water Supplies:

In the year 1930 a policy was adopted for publishing every five years certain tables of average chemical analyses to permit comparison of the various public water supplies of the State. In accordance with this policy the following tables are presented to show comparisons of the color, albuminoid ammonia and hardness in the surface waters and the iron and hardness in the ground waters:

Iron in Ground Waters

(Parts per Million)

City or Town	Source	Iron 1940
Auburn (Water Company)	Tubular wells	.03
Avon	Dug and tubular wells	.03
Canton	Henry's spring well	.03
Chatham (Water Company)	Tubular wells	.03
Colrain (Lyonsville)	Deep tubular well	.03
Deerfield (Fire District)	North springs	.03
Duxbury (Fire and Water District)	Tubular wells	.03
Easthampton	Tubular wells	.03
Edgartown (Water Company)	Dug and tubular wells	.03
Grafton (Water Company)	Gravel-packed well at North Grafton	.03
Kingston	Tubular wells	.03
Marion	Old tubular wells	.03
Monson	New dug well	.03
Nantucket (Wannacomet Water Company)	Dug and tubular wells at Wyers Valley	.03
(Siasconset)	Dug wells	.03
Needham	Dug well No. 1	.03
NEWTON	Dug well No. 4	.03
Northbridge	Tubular wells (Cook Allen)	.03
Oxford (Water Company)	Tubular wells	.03
Palmer (Three Rivers)	Cheney Supply collecting well	.03
Scituate	Kent Street wells	.03
Sheffield (Water Company)	Smith Spring	.03
Walpole	Tubular wells	.03
Ware	Large well, treated	.03
Wellesley	Dug well at pumping station No. 2	.03
Westford (Abbot Worsted Company)	Tubular wells	.03
Weston (Water Company)	Dug well A	.03
West Stockbridge (Water Company)	Johnson's Spring	.03
	Blake's Spring	.03
WOBURN	Gravel-packed well B	.03
	Gravel-packed well D	.03
Acton (West and South Water Supply District)	Tubular wells	.04
Barnstable (Centerville-Osterville Fire District)	Gravel-packed wells	.04
Belchertown (Water District)	Tubular wells	.04
Bellingham	Gravel-packed well No. 1	.04
	Gravel-packed well No. 2	.04
Bernardston (Fire and Water District)	Dug well	.04
Bourne (Buzzards Bay Water District)	Tubular wells	.04
(Sagamore Beach)	Tubular wells	.04
Canton	Springdale well	.04
Cummington	Springs	.04
Deerfield (Fire District)	Harris Springs	.04
Douglas	Tubular wells	.04
Dudley	Tubular wells	.04
Grafton (Water Company)	Dug wells at Grafton	.04
Hamilton	Gravel-packed and tubular wells	.04
Hardwick (Wheelwright)	Tubular wells	.04
Hopkinton	Tubular wells	.04
Littleton	Tubular wells	.04
Marshfield	Main supply—tubular wells	.04
Millbury (Water Company)	Dug well	.04
Natick	Dug well	.04
Needham	Dug well No. 2	.04
NEWTON	Dug well No. 1	.04
	Dug well No. 2	.04
	Dug well No. 3	.04
Northbridge	Tubular wells (Meadow Pond)	.04
Norwood	Final effluent	.04
Sharon	Dug and tubular wells	.04
Sheffield (Water Company)	Farm House Spring	.04
Shrewsbury	Gravel-packed wells (Oak Street)	.04
Stockbridge (Hill Water Company)	Springs	.04
Tisbury	Tashmoo Spring	.04
Townsend	Tubular wells	.04
WALTHAM	New dug well	.04
Warren (Warren Water District)	Tubular wells	.04
Wellesley	Tubular wells at pumping station No. 1	.04
	Gravel-packed well at pumping station No. 4	.04
Williamstown (Water Company)	Cold Spring	.04
WOBURN	Gravel-packed well A–2	.04
	Gravel-packed well E	.04
Yarmouth	Tubular wells	.04
ATTLEBORO	Gravel-packed wells (South Attleboro)	.05
Bourne (Bourne Water District)	Gravel-packed wells	.05
(Sagamore-Savery Supply)	Tubular wells	.05

Iron in Ground Waters—Continued

(Parts per Million)

City or Town	Source	Iron 1940
Bridgewater	Tubular wells	.05
Granville (Center Water Co.)	Well and spring	.05
Great Barrington (Fire District)	New filtration gallery near Green River	.05
Groton (West Groton Water Supply District)	Tubular wells	.05
Lynnfield (Pitman Supply)	Dug well	.05
Medfield	Tubular wells	.05
Provincetown	Tubular wells	.05
Rockport	Tubular wells	.05
Scituate	Webster Meadow wells	.05
	Beaver Dam wells	.05
Stoughton	Collecting well system	.05
Topsfield (Topsfield Water Company, Inc.)	Dug and tubular wells	.05
Westford (Water Company)	Tubular wells (Westford)	.05
Weston (Keewaydin Water Works)	Dug well	.05
Winchester	Pond Street wells	.05
Wrentham	Large tubular wells	.05
Attleboro	Dug wells and filtered water (South Attleboro)	.06
East Brookfield	Well	.06
Framingham	Gravel-packed well No. 3	.06
Gosnold	Well	.06
Hardwick (Gilbertville)	Dug and tubular wells	.06
Harwich	Gravel-packed wells	.06
Manchester	Dug and tubular wells	.06
Monson	Old dug well	.06
South Hadley (Fire District No. 2)	Dug wells	.06
Uxbridge	Tubular wells, new system	.06
	Springs, old system	.06
Webster	Tubular wells	.06
Westborough	Filter basin	.06
Wilmington	Tubular wells	.06
Ayer	Dug well	.07
Barnstable (Fire District)	Tap in Town—Yarmouth supply	.07
Canton	Ward well	.07
Gill (Riverside Water Company)	Spring	.07
Hingham (Water Company)	Filter galleries	.07
Mansfield	Dug well	.07
Needham	Gravel-packed well (Charles River Street)	.07
Palmer (Thorndike)	Hamilton Reservoir	.07
Wareham (Wareham Fire District)	Tubular wells	.07
Ashland	New tubular wells	.08
Cohasset (Water Company)	Filtered water	.08
Easton (North Easton Village District)	Dug well	.08
Holliston (Water Company)	Gravel-packed well	.08
Leicester (Water Supply District)	Dug wells	.08
Marshfield	Parsonage Street—tubular wells	.08
Millis	Dug well	.08
Sheffield (Water Company)	Red Rock Spring	.08
Sterling	Tubular wells	.08
Weston	Tubular wells at Warren Avenue	.08
Bedford	Dug well	.09
Colrain (Griswoldville)	Deep tubular well	.09
Fairhaven (Water Company)	Tubular wells near Mattapoisett River	.09
Marshfield	Brant Rock Supply—dug wells	.09
Newton	Tap in pumping station (treated water)	.09
Orange	Crystal Spring	.09
Sudbury	Tubular wells	.09
Upton (Wm. Knowlton and Sons, Company)	Tubular wells	.09
Whately (Craft's Supply)	Springs	.09
Dover	Tubular wells	.10
Georgetown	Tubular wells	.10
Lanesborough (Village Water District)	Tubular wells	.10
Marion	New tubular wells	.10
Palmer (Bondsville Water Company)	Tubular wells	.10
Weston (Glen Farms Water Company)	Dug well	.10
Worthington (Fire District)	Springs	.10
Barnstable (Cotuit Fire District)	Gravel-packed wells	.11
Bourne (Sagamore-Ware Tenement Supply)	Tubular wells	.11
North Reading	Tap in town—Wilmington Supply	.11
Warren (West Warren Water Company)	Dug wells	.11
Winchendon	New dug well	.11
Weston	Tubular wells at Kendal Green	.12
(Water Company)	Dug well C	.12
Bourne (Sagamore-Knowlton Property)	Tubular wells	.13
Georgetown	Tubular wells, settled coke filter effluent	.13
Leicester (Cherry Valley and Rochdale Water District)	Dug wells	.13
Merrimac	Tubular wells	.13
Shirley (Shirley Village Water District)	Dug wells	.13
West Brookfield	Tubular wells	.13
Woburn	Gravel-packed well A	.13
Brookline	Tubular wells, gravel-packed wells and filter gallery, filtered	.14
Chelmsford (Water District)	Tubular wells	.14
Groton (Water Company)	Dug well	.14
Marblehead	Dug and tubular wells, filtered	.14
Middleborough	Final effluent (dug well filtered)	.14
Deerfield (Fire District)	South springs	.15

Iron in Ground Waters—Concluded

(Parts per Million)

City or Town	Source	Iron 1940
Hanover	Tubular wells	.15
Foxborough	Tubular wells	.16
Dunstable	Tubular wells	.17
Milford (Milford Water Company)	Wells—outlets of filters	.17
Norwood	Tubular wells—raw water	.17
Reading	New tubular wells, filtered	.17
Norton	Tubular wells	.18
Bourne (Sagamore-Keith Block)	Tubular wells	.19
Dracut (Water Supply District)	Tubular wells, (Dracut)	.19
Framingham	Gravel-packed well No. 1	.19
Needham	Tubular wells (Great Plain Avenue)	.20
Sutton (Water Company)	Dug and tubular wells	.20
Dedham (Water Company)	Dug and tubular wells (Dedham)	.21
Wayland	Gravel-packed and tubular wells	.21
Wellesley	Large tubular well at pumping station No. 3	.21
Barnstable (Centerville-Osterville Fire District)	Tubular wells	.22
Montague (Montague Village)	Springs	.22
Pepperell	Tubular wells	.22
Sharon	Tubular wells	.22
Westwood (Water Company)	Tubular wells	.22
Mattapoisett	Tubular wells	.24
Paxton	Spring	.24
Barnstable (Water Company)	Tubular wells (old supply)	.25
Bedford	Tubular wells	.25
Amesbury	Tubular wells, filtered	.26
Shrewsbury	Gravel-packed wells (South Street)	.26
Oak Bluffs (Cottage City Water Company)	Springs	.27
Fairhaven (Water Company)	Tubular wells near Mattapoisett River	.30
Medway	Tubular wells	.32
Marblehead	Tubular wells	.33
Wakefield	Tubular wells	.35
Greenfield	Dug well near Green River	.37
Grafton (Saundersville Supply)	Springs	.38
Winchendon	Old dug well	.40
Marshfield	Humarock Beach—tubular wells	.42
Colrain (Lyonsville)	Spring	.43
Grafton (Fisherville Supply)	Springs and deep tubular wells	.45
Bourne (Sagamore Heights)	Tubular wells	.49
Chelmsford (North Chelmsford Fire District)	Tubular wells	.54
Franklin	Tubular wells	.56
Billerica	Gravel-packed wells	.59
Lowell	Effluent of sand filter	.60
Methuen	Lone Tree Hill wells	.64
Hardwick (Center)	Dug well	.65
Somerset	Tubular wells	.65
Framingham	Gravel-packed well No. 2	.66
Ayer	Tubular wells	.71
Salisbury (Water Supply Company)	New well and gravel-packed well	.76
Marblehead	Dug well	.80
Sturbridge	Tubular wells	.88
Methuen (Harris Brook P. S.)	Gravel-packed well	.95
North Attleborough	Dug wells	1.00
Reading	New tubular wells	1.00
Dracut (Water Supply District)	Tubular wells (Lakeview)	1.20
Georgetown	Tubular wells—raw water	1.20
Brookline	Tubular wells, gravel-packed wells, and filter gallery, raw water	1.32
Waltham	Old dug well	1.35
Cohasset (Water Company)	Raw water at filter plant	1.50
Lowell	Boulevard wells, raw water	1.90
Middleborough	Dug well	2.90
Lowell	Cook wells	3.50
Amesbury	Tubular wells	5.40

Hardness in Ground Water

(Parts per Million)

City or Town	Source	Hardness 1940
Edgartown (Water Company)	Dug and tubular wells	5
Barnstable (Centerville-Osterville Fire District)	Tubular wells	6
Bourne (Buzzards Bay Water District)	Tubular wells	6
Barnstable (Centerville-Osterville Fire District)	Gravel-packed wells	7
(Cotuit Fire District)	Gravel-packed wells	7
Bourne (Bourne Water District)	Gravel-packed wells	7
Tisbury	Tashmoo Springs	7
Townsend	Tubular wells	7
Barnstable (Fire District)	Tap in town—Yarmouth water supply	8
Chatham (Water Company)	Tubular wells	8
Northbridge	Tubular wells (Cook Allen)	8
Marshfield	Main supply—tubular wells	9
Winchendon	New dug well	9
Bourne (Sagamore-Knowlton Property)	Tubular wells	10
(Sagamore-Savery Supply)	Tubular wells	10

Hardness in Ground Water—Continued

(Parts per Million)

City or Town	Source	Hardness 1940
Granville (Center Water Company)	Well and springs	10
Monson	New dug well	10
Orange	Crystal Spring	10
Worthington (Fire District)	Springs	10
Hardwick (Wheelwright)	Tubular wells	11
Oak Bluffs (Cottage City Water Company)	Springs	11
Stoughton	Collecting well system	11
Uxbridge	Springs, old system	11
Bourne (Sagamore Heights)	Tubular wells	12
East Brookfield	Well	12
Grafton (Saundersville Supply)	Springs	12
Harwich	Gravel-packed wells	12
Wareham (Wareham Fire District)	Tubular wells	12
Westborough	Filter basin	12
Barnstable (Water Company)	Tubular wells (old supply)	13
Duxbury (Fire and Water District)	Tubular wells	13
Kingston	Tubular wells	13
Monson	Old dug well	13
Warren (Warren Water District)	Tubular wells	13
Yarmouth	Tubular wells	13
Bedford	Dug well	14
Bourne (Sagamore Beach)	Tubular wells	14
Paxton	Spring	14
Pepperell	Tubular wells	14
Marion	Old tubular wells	15
Palmer (Three Rivers)	Cheney Supply collecting well	15
(Thorndike)	Hamilton Reservoir	15
Sheffield (Water Company)	Red Rock Spring	15
Bernardston (Fire and Water District)	Dug well	16
Bourne (Sagamore-Ware Tenement Supply)	Tubular wells	16
Mansfield	Dug well	16
Northbridge	Tubular wells (Meadow Pond)	16
West Brookfield	Tubular wells	16
Winchendon	Old dug well	16
Deerfield (Fire District)	South Springs	17
Dudley	Tubular wells	17
Bedford	Tubular wells	18
Bellingham	Gravel-packed well No. 1	19
Franklin	Tubular wells	19
Nantucket (Siasconset)	Dug wells	19
Norton	Tubular wells	19
Bridgewater	Tubular wells	20
Grafton (Fisherville Supply)	Springs and deep tubular wells	20
Leicester (Cherry Valley and Rochdale Water District)	Dug wells	20
Littleton	Tubular wells	20
Marshfield	Brant Rock Supply—dug wells	20
	Humarock Beach—tubular wells	20
Sheffield (Water Company)	Smith Spring	20
Webster	Tubular wells	20
Bellingham	Gravel-packed well No. 2	21
Easton (North Easton Village District)	Dug well	21
Hardwick (Center)	Dug well	21
Nantucket (Wannacomet Water Company)	Dug and tubular wells at Wyers Valley	21
Dunstable	Tubular wells	22
Sheffield (Water Company)	Farm House Spring	22
Sturbridge	Tubular wells	22
Warren (West Warren Water Company)	Dug well	22
Westford (Water Company)	Tubular wells (Westford)	22
Bourne (Sagamore-Keith Block)	Tubular wells	23
Canton	Springdale well	23
Cummington	Springs	23
Holliston (Water Company)	Gravel-packed well	23
Montague (Montague Village)	Springs	23
Oxford (Water Company)	Tubular wells	23
Douglas	Tubular wells	24
Foxborough	Tubular wells	24
Georgetown	Tubular wells (raw water)	24
Walpole	Tubular wells	24
Ashland	New tubular wells	25
Attleboro	Gravel-packed wells (South Attleboro)	25
Chelmsford (North Chelmsford Fire District)	Tubular wells	25
Middleborough	Dug well	25
	Final effluent (dug well filtered)	25
Millbury (Water Company)	Dug well	25
Shrewsbury	Gravel-packed wells (Oak Street)	25
Canton	Ward well	26
Deerfield (Fire District)	North springs	26
Georgetown	Tubular wells, settled coke filter effluent	26
	Tubular wells	26
Grafton (Water Company)	Gravel-packed well at North Grafton	26
Hanover	Tubular wells	26
Mattapoisett	Tubular wells	26
Sharon	Tubular wells	26
Shrewsbury	Gravel-packed wells (South Street)	26
Somerset	Tubular wells	26
Fairhaven (Water Company)	Tubular wells near Mattapoisett River	27

Hardness in Ground Water—Continued

(Parts per Million)

City or Town	Source	Hardness 1940
Hopkinton	Tubular wells	27
Lowell	Boulevard wells, raw water	27
	Effluent of sand filter	27
North Reading	(Wilmington Supply)	27
Shirley (Shirley Village Water District)	Dug wells	27
Uxbridge	Tubular wells, new system	27
Wilmington	Tubular wells	27
Canton	Henry's Spring well	28
Cohasset (Water Company)	Raw water at filter plant	28
Ware	Large well, treated	28
Avon	Dug and tubular wells	29
Sudbury	Tubular wells	29
Upton (Wm. Knowlton and Sons, Company)	Tubular wells	29
Weston (Keewaydin Water Works)	Dug well	29
Wrentham	Large tubular wells	29
Billerica	Gravel-packed wells	30
Deerfield (Fire District)	Harris Springs	30
Fairhaven (Water Company)	Tubular wells near Nasketucket River	30
Merrimac	Tubular wells	30
Milford (Milford Water Company)	Outlet of filters	30
Palmer (Bondsville Water Company)	Tubular wells	30
South Hadley (Fire District No. 2)	Dug wells	31
Groton (West Groton Water Supply District)	Tubular wells	32
Hamilton	Gravel-packed and tubular wells	32
Weston	Tubular wells at Kendal Green	32
Belchertown (Water District)	Tubular wells	33
Leicester (Water Supply District)	Dug wells	33
Newton	Tap in pumping station, treated water	33
Sterling	Tubular wells	33
Weston (Water Company)	Dug well A	33
Marshfield	Parsonage Street—tubular wells	34
Medway	Tubular wells	34
Newton	Dug well No. 3	34
Wellesley	Dug well at pumping station No. 2	34
Weston (Water Company)	Dug Well C	34
Framingham	Gravel-packed well No. 3	35
Greenfield	Dug well near Green River	35
Hardwick (Gilbertville)	Dug and tubular wells	35
Gill (Riverside Water Company)	Spring	36
Westford (Abbot Worsted Company)	Tubular wells	36
Westwood (Water Company)	Tubular wells	36
Lowell	Cook wells	37
Methuen	Gravel-packed well	37
Needham	Dug well No. 1	37
Newton	Dug well No. 2	37
Waltham	New dug well	37
Wellesley	Large tubular well at pumping station No.3	37
Needham	Dug well No. 238	38
Attleboro	Dug wells and filtered water (South Attleboro)	39
Colrain (Lyonsville)	Spring	39
Newton	Dug well No. 1	39
Wellesley	Gravel-packed well at pumping station No. 4	39
Woburn	Gravel-packed well D	39
Acton (West and South Water Supply District)	Tubular wells	40
Ayer	Dug well	40
Hingham (Water Company)	Filter galleries	40
Medfield	Tubular wells, tap in town	40
Dedham (Water Company)	Dug and tubular wells (Dedham)	41
Manchester	Dug and tubular wells	41
Norwood	Tubular wells, raw water	42
Wellesley	Tubular wells at pumping station No. 1	42
Marion	New tubular wells	43
Norwood	Final effluent	43
Rockport	Tubular wells	43
Scituate	Webster Meadow wells	43
Weston (Glen Farms Water Company)	Dug well	43
Chelmsford (Water District)	Tubular wells	44
Framingham	Gravel-packed well No. 2	44
Provincetown	Tubular wells	44
Stockbridge (Hill Water Company)	Springs	44
Waltham	Old dug well	44
Easthampton	Tubular wells	45
Groton (Water Company)	Dug well	45
Newton	Dug well No. 4	45
Ayer	Tubular wells	46
Dover	Tubular wells	46
Wayland	Gravel-packed and tubular wells	46
Brookline	Tubular wells, gravel-packed wells and filter galleries, filtered	47
Grafton (Water Company)	Dug wells at Grafton	47
Methuen	Lone Tree Hill wells	47
Needham	Tubular wells (Great Plain Avenue)	47
Reading	New tubular wells, filtered	47
Framingham	Gravel-packed well No. 1	49
Weston	Tubular wells at Warren Ave.	49

Hardness in Ground Water—Concluded

(Parts per Million)

City or Town	Source	Hardness 1940
Brookline	Tubular wells, gravel-packed wells and filter gallery, raw water	50
Colrain (Griswoldville)	Deep tubular well	50
Reading	New tubular wells	50
Woburn	Gravel-packed well B	50
Salisbury (Water Supply Company)	New dug well and gravel-packed well	51
Woburn	Gravel-packed well E	51
	Gravel-packed well A	52
Great Barrington (Fire District)	New infiltration gallery near Green River	55
Needham	Gravel-packed well (Charles River Street)	55
Cohasset (Water Company)	Filtered water	56
Scituate	Beaver Dam wells	56
Wakefield	Tubular wells	56
Natick	Dug well	57
Woburn	Gravel-packed well A–2	57
Auburn (Water Company)	Tubular wells	59
Sutton (Water Company)	Dug and tubular wells	59
North Attleborough	Dug wells	60
Dracut	Tubular wells, (Dracut)	61
Millis	Dug wells	64
Amesbury	Tubular wells	66
	Tubular wells, filtered	66
Whately (Craft's Supply)	Springs	77
Colrain (Lyonsville)	Deep tubular well	79
Marblehead	Dug well	83
Sharon	Dug well and tubular wells	85
Marblehead	Dug and tubular wells, filtered	87
West Stockbridge (Water Company)	Johnson's Spring	90
Scituate	Kent Street wells	93
Dracut (Water Supply District)	Tubular wells, Lakeview	94
Winchester	Pond Street wells	95
Gosnold	Well	104
Topsfield (Topsfield Water Company, Inc.)	Dug and tubular wells	116
Marblehead	Tubular wells	118
West Stockbridge (Water Company)	Blake's Spring	123
Williamstown (Water Company)	Cold Spring	135
Lynnfield (Pitman's Supply)	Dug well	151
Lanesborough (Village Water District)	Tubular wells	186

Color of Surface Waters

(Parts per Million)

City or Town	Source	Color 1940
Cheshire (Water Company)	Kitchen Brook Reservoir	0
Williamstown (Water Company)	Sherman Spring Reservoir	0
Chicopee	Cooley Brook Reservoir, filtered	1
Adams (Fire District)	Bassett Brook Reservoir	2
Falmouth	Long Pond, before lime treatment	2
Maynard	White Pond	2
North Adams	Mount Williams Reservoir	2
Plymouth	Little South Pond	2
	Great South Pond	2
Salem	Wenham Lake, filtered	2
Williamstown (Water Company)	Paul Brook	2
Braintree	Great Pond, filtered	3
Monterey (Water Company)	Reservoir	3
Northborough	Final effluent	3
Shelburne (Falls Fire District)	Fox Brook Reservoir	3
South Hadley (Fire District No. 2)	Elmer Brook, filtered	3
Sunderland (Water Company)	Saw Mill Brook Reservoir	3
Wareham (Onset Fire District)	Jonathan Pond	3
Williamstown (Water Company)	Rattlesnake Brook Reservoir	3
Athol	Final effluent	4
Great Barrington (Housatonic Water Works Company)	Long Pond, filtered	4
Greenfield	Filter Plant, outlet of filter	4
Hadley (Water Supply District)	Hart's Brook Reservoir	4
Hatfield	Running Gutter Brook Reservoir	4
Lenox (Water Company)	Lower Root Reservoir	4
	Woolsey Reservoir	4
Leominster	No-Town Reservoir and Simonds Pond, filtered	4
Lincoln	Sandy Pond	4
Rockport	Cape Pond, filtered	4
West Springfield	Bear Hole Brook Reservoir, filtered	4
Blandford (Fire District)	Freeland Brook	5
Cambridge	Filter effluent	5
Concord	Nagog Pond	5
Egremont (South Egremont Water Company)	Goodale Brook Reservoir	5
Holyoke	Hugh McLean Reservoir	5
	Whiting Street Reservoir	5
North Adams	Notch Brook Reservoir	5
Pittsfield	Hathaway Brook Reservoir	5

Color of Surface Waters—Continued

(Parts per Million)

City or Town	Source	Color 1940
Rutland	Muschopauge Lake	5
Winchester	South Reservoir	5
Ashburnham	Upper Naukeag Lake	6
Colrain (Griswoldville)	McClellan Brook Reservoir	6
Haverhill	Pentucket Lake	6
Lynn	Birch Pond	6
Montague (Turners Falls Fire District)	Lake Pleasant	6
Northampton	Mountain Street Reservoir	6
South Hadley (Fire District No. 2)	Elmer Brook, raw water	6
Springfield	Ludlow Reservoir, filtered	6
Spencer	Shaw Pond	6
Westhampton (Water Company)	Reservoir	6
Weymouth	Great Pond, filtered	6
Winchester	North Reservoir	6
Abington	Big Sandy Pond	7
Barre	Reservoir	7
Chicopee	Morton Brook	7
Colrain (Fire District No. 1)	Mountain Brook Reservoir	7
Great Barrington (Fire District)	East Mountain Reservoir	7
Hinsdale (Fire District)	Reservoir	7
Leominster	Fall Brook Reservoir	7
Marlborough	Lake Williams	7
Newburyport	Ground and reservoir water, filtered	7
Northfield (Schools Inc.)	Upper Reservoir on Louisiana Brook	7
South Hadley (Fire District No. 1)	Leaping Well Reservoir	7
Westfield	Winchell Reservoir	7
	Granville Reservoir	7
Fall River	North Watuppa Lake	8
Great Barrington (Housatonic Water Works Company)	Long Pond, raw water	8
Greenfield	Filter plant, raw water	8
Hudson	Gates Pond	8
Huntington (Fire District)	Cold Brook Reservoir	8
Lee (Berkshire Water Company)	Codding Brook Lower Reservoir	8
Monroe (Water District)	Phelps Brook Reservoir	8
Northfield (Schools, Inc.)	Lower Reservoir on Louisiana Brook	8
Norwood	Buckmaster Pond, filtered	8
Worcester	Lower Holden Reservoir	8
	Kendall Reservoir	8
Brockton	Silver Lake	9
Chester	Austin Brook Reservoir	9
Deerfield (South Deerfield Water Supply District)	Roaring Brook Reservoir	9
Fitchburg	Scott Reservoir	9
	Meetinghouse Pond	9
	Wachusett Lake	9
Springfield	Cobble Mountain Reservoir, filtered	9
West Springfield	Bear Hole Brook Reservoir	9
Amherst (Water Company)	Atkins Pond	10
Holyoke	Wright and Ashley ponds	10
Lee (Berkshire Water Company)	Codding Brook Upper Reservoir	10
Leominster	Morse Reservoir	10
Norwood	Buckmaster Pond, raw water	10
Pittsfield	Ashley Lake	10
Russell	Black Brook Reservoir, filtered	10
Stockbridge (Water Company)	Lake Averic	10
Wakefield	Crystal Lake, filtered	10
West Stockbridge (Water Company)	East Mountain Reservoir	10
Williamsburg	Unquomonk Brook Reservoir	10
Worcester	Pine Hill Reservoir	10
	Upper Holden Reservoir	10
Gardner	Crystal Lake	11
Winchester	Middle Reservoir	11
Clinton	Spring Basin	12
Gloucester	Haskell Reservoir	12
Lawrence	Merrimack River, filtered	12
Leominster	Haynes Reservoir	12
North Adams	Broad Brook	12
Peabody	Spring Pond	12
Pittsfield	Ashley Reservoir	12
Southbridge	Hatchet Brook Reservoir No. 5	12
Springfield	Ludlow Reservoir, unfiltered	12
Cambridge	Fresh Pond	13
Clinton	Lower Lynde's Reservoir	13
Newburyport	Mixed Raw Water	13
Northfield (Water Company)	Minot Brook Reservoir	13
Southbridge	Hatchet Brook Reservoir No. 4	13
Taunton	Elder's Pond	13
Metropolitan Water District	Wachusett Reservoir, lower end	14
	Chestnut Hill Reservoir	14
	Tap in Quincy	14
Fitchburg	Lovell Reservoir	14
Newburyport	Collecting basin	14
Sppingfield	Cobble Mountain Reservoir	14
Worcester	Leicester Reservoir (Lynde Reservoir)	14
	Mann Reservoir (Kettle Brook No. 2)	14

Color of Surface Waters—Continued

(Parts per Million)

City or Town	Source	Color 1940
Metropolitan Water District	Sudbury Reservoir	15
	Framingham Reservoir No. 3	15
	Weston Reservoir	15
Andover	Haggett's Pond	15
Brookfield	Cooley Hill Reservoir	15
Cambridge	Lower Hobbs Brook Reservoir	15
Chester	Horn Pond	15
Falmouth	Long Pond, treated	15
Palmer (Fire District No. 1)	Graves Brook, Lower Reservoir	15
Pittsfield	Sackett Reservoir	15
Southbridge	Hatchett Brook Reservoir No. 3	15
West Newbury	Tap in town—Groveland Supply	15
Metropolitan Water District	Spot Pond	16
	Tap in State House	16
Clinton	Heywood Pond	16
North Andover	Great Pond	16
South Hadley (Fire District No. 1)	Buttery Brook Reservoir	16
Wakefield	Crystal Lake	16
Gloucester	Wallace Reservoir	17
Haverhill	Crystal Lake	17
Manchester	Gravel Pond	17
Metropolitan Water District	Lake Cochituate	18
	Tap in Revere	18
Northampton	Middle Reservoir (Roberts Meadow Brook)	18
Worcester	Kent Reservoir (Kettle Brook No. 1)	18
Fitchburg	Falulah Reservoir	19
Haverhill	Johnson's Pond	19
Holyoke	White Reservoir	19
Hingham (Water Company)	Accord Pond	19
Milford (Water Company)	Dug wells and Charles River, filtered	19
Southborough	Sudbury Reservoir	19
Haverhill	Kenoza Lake	20
Holyoke	Carmody Reservoir	20
Russell	Black Brook Reservoir	20
Dalton (Fire District)	Raw water	22
	Windsor Reservoir	22
Gloucester	Dike's Brook Reservoir	22
North Brookfield	North Pond	22
Dalton (Fire District)	Filtered water	23
Leominster	No-Town Reservoir	23
New Bedford	Little Quittacas Pond	23
Orange	Coolidge Brook Reservoir	23
Peabody	Suntaug Lake	23
Ashfield (Water Company)	Highland Spring Reservoir	24
Athol	Newton Reservoir	24
Cambridge	Upper Hobbs Brook Reservoir	24
Lynn	Breeds Pond	24
Worcester	Bottomly Reservoir (Kettle Brook No. 4)	24
Randolph	Filtered water	25
Dalton (Fire District)	Egypt Brook Reservoir	26
Fitchburg	Ashby Reservoir	26
Metropolitan Water District	Wachusett Reservoir, upper end	28
Milford (Water Company)	Charles River, inlet to filters	28
North Brookfield	Doane Pond	28
Taunton	Assawompsett Pond	28
Ipswich	Dow's Brook Reservoir	29
Newburyport	Artichoke River	29
Rockport	Cape Pond, raw water	29
Amherst (Water Company)	Amethyst Brook—Intake Reservoir	30
Pittsfield	Mill Brook Reservoir	30
Braintree	Great Pond, raw water	31
Chicopee	Cooley Brook Reservoir, raw water	31
Randolph	Great Pond, raw water	31
Salem	Wenham Lake	31
Metropolitan Water District	Ware River at Coldbrook intake	33
Worcester	Quinapoxet Pond	33
New Bedford	Great Quittacas Pond	34
Westfield	Montgomery Reservoir	34
Lee (Berkshire Water Company)	Basin Pond Brook	36
Lynn	Walden Pond	36
Weymouth	Great Pond	36
Athol	Phillipston Reservoir	39
Metropolitan Water Supply	Hopkinton Reservoir	39
Cambridge	Stony Brook Reservoir	41
Lawrence	Merrimack River	41
Pittsfield	Farnham Reservoir	41
Marlborough	Millham Brook Reservoir	42
Stoughton	Muddy Pond	44
Gloucester	Babson Reservoir	45
Danvers	Middleton Pond	46
Metropolitan Water District	Ashland Reservoir	47
Salem	Ipswich River at Pumping Station	47
Athol	Raw water at filter plant	54
Northborough	Cold Harbor Brook, raw water	57
Haverhill	Millville Reservoir	62
Lynn	Hawkes Pond	66

Color of Surface Waters—Concluded

(Parts per Million)

City or Town	Source	Color 1940
Metropolitan Water District	Framingham Reservoir No. 2	72
Ipswich	Bull Brook Reservoir	77
PITTSFIELD	Sand Wash Brook	86
SALEM	Longham Reservoir	91
Athol	Thousand Acre Meadow Brook	142

Albuminoid Ammonia in Surface Waters

(Parts per Million)

City or Town	Source	Albuminoid Ammonia 1940
Sunderland (Water Company)	Saw Mill Brook Reservoir	.010
Blandford (Fire District)	Freeland Brook	.012
Williamstown (Water Company)	Rattlesnake Brook Reservoir	.012
Colrain (Griswoldville)	McClellan Brook Reservoir	.014
Lee (Berkshire Water Company)	Codding Brook Lower Reservoir	.015
Shelburne (Falls Fire District)	Fox Brook Reservoir	.015
Williamstown (Water Company)	Sherman Spring Reservoir	.015
Colrain (Fire District No. 1)	Mountain Brook Reservoir	.017
Egremont (South Egremont Water Company)	Goodale Brook Reservoir	.017
West Springfield	Bear Hole Brook Reservoir, filtered	.018
Cheshire (Water Company)	Kitchen Brook Reservoir	.019
Monterey (Water Company)	Reservoir	.019
Westhampton (Water Company)	Reservoir	.019
Williamstown (Water Company)	Paul Brook	.019
Russell	Black Brook Reservoir, filtered	.020
Lenox (Water Company)	Woolsey Reservoir	.022
South Hadley (Fire District No. 2)	Elmer Brook, filtered	.023
CHICOPEE	Cooley Brook Reservoir, filtered	.024
Hatfield	Running Gutter Brook Reservoir	.024
Huntington (Fire District)	Cold Brook Reservoir	.025
Northfield (Water Company)	Minot Brook Reservoir	.025
PITTSFIELD	Hathaway Brook Reservoir	.028
Greenfield	Filter plant, outlet of filter	.030
CHICOPEE	Morton Brook	.032
West Stockbridge (Water Company)	East Mountain Reservoir	.032
Lee (Berkshire Water Company)	Codding Brook Upper Reservoir	.033
Monroe (Water District)	Phelps Brook Reservoir	.035
SPRINGFIELD	Cobble Mountain Reservoir, filtered	.036
Hadley (Water Supply District)	Hart's Brook Reservoir	.038
Northborough	Final effluent	.038
NORTH ADAMS	Notch Brook Reservoir	.039
Lenox (Water Company)	Lower Root Reservoir	.040
Athol	Final effluent	.041
Milford (Water Company)	Dug wells and Charles River, filtered	.042
Williamsburg	Unquomonk Brook Reservoir	.042
Ashburnham	Upper Naukeag Lake	.045
Chester	Austin Brook Reservoir	.046
Hinsdale (Fire District)	Reservoir	.047
Russell	Black Brook Reservoir	.048
Deerfield (South Deerfield Water Supply District)	Roaring Brook Reservoir	.049
PITTSFIELD	Sackett Reservoir	.050
South Hadley (Fire District No. 2)	Elmer Brook, raw water	.052
Weymouth	Great Pond, filtered	.052
LEOMINSTER	No-Town Reservoir and Simonds Pond, filtered	.053
PITTSFIELD	Ashley Reservoir	.053
West Springfield	Bear Hole Brook Reservoir	.053
WESTFIELD	Winchell Reservoir	.054
Great Barrington (Fire District)	East Mountain Reservoir	.055
Barre	Reservoir	.056
Norwood	Buckmaster Pond, filtered	.056
CAMBRIDGE	Filter effluent	.058
Dalton (Fire District)	Filtered water	.058
NORTH ADAMS	Mount Williams Reservoir	.058
Orange	Coolidge Brook Reservoir	.058
Northfield (Schools, Inc.)	Upper Reservoir on Louisiana Brook	.059
Metropolitan Water District	Tap in Quincy	.060
Greenfield	Filter Plant, raw water	.061
Plymouth	Great South Pond	.061
Northfield (Schools, Inc.)	Lower Reservoir on Louisiana Brook	.062
Dalton (Fire District)	Egypt Brook Reservoir	.064
Falmouth	Long Pond, treated	.065
Dalton (Fire District)	Raw water	.067
Montague (Turners Falls Fire District)	Lake Pleasant	.067
Adams (Fire District)	Bassett Brook Reservoir	.069
Falmouth	Long Pond, before lime treatment	.069
SALEM	Wenham Lake, filtered	.085
NORTH ADAMS	Broad Brook	.086
Southborough	Sudbury Reservoir	.086
Lincoln	Sandy Pond	.087
Great Barrington (Housatonic Water Works Company)	Long Pond, filtered	.088
WORCESTER	Mann Reservoir (Kettle Brook No. 2)	.088
Metropolitan Water District	Tap in Revere	.089

Albuminoid Ammonia in Surface Waters—Continued
Parts per Million)

City or Town	Source	Albuminoid Ammonia 1940
Clinton	Spring Basin	.090
Hingham (Water Company)	Accord Pond	.090
Lawrence	Merrimack River, filtered	.091
Metropolitan Water District	Wachusett Reservoir, lower end	.094
	Framingham Reservoir No. 3	.095
Southbridge	Hatchet Brook Reservoir No. 5	.095
Worcester	Kendall Reservoir	.095
Gloucester	Dike's Brook Reservoir	.096
Worcester	Kent Reservoir (Kettle Brook No. 1)	.096
South Hadley (Fire District No. 1)	Leaping Well Reservoir	.097
Westfield	Granville Reservoir	.097
Holyoke	Wright and Ashley Ponds	.098
	White Reservoir	.098
Southbridge	Hatchett Brook Reservoir No. 3	.098
	Hatchett Brook Reservoir No. 4	.098
Metropolitan Water District	Chestnut Hill Reservoir	.099
	Tap in State House	.099
Amherst (Water Company)	Amethyst Brook—Intake Reservoir	.099
Chicopee	Cooley Brook Reservoir, raw water	.099
Holyoke	Whiting Street Reservoir	.099
Hudson	Gates Pond	.099
Leominster	Fall Brook Reservoir	.100
Newburyport	Mixed raw water	.100
Amherst (Water Company)	Atkins Pond	.102
Metropolitan Water District	Wachusett Reservoir, upper end	.103
Clinton	Lower Lynde's Reservoir	.103
Worcester	Pine Hill Reservoir	.103
Holyoke	Carmody Reservoir	.104
Leominster	Morse Reservoir	.104
Winchester	South Reservoir	.104
Fitchburg	Ashby Reservoir	.105
	Meetinghouse Pond	.105
Newburyport	Collecting basin	.105
Metropolitan Water District	Sudbury Reservoir	.106
Abington	Big Sandy Pond	.106
Concord	Nagog Pond	.106
South Hadley (Fire District No. 1)	Buttery Brook Reservoir	.106
Westfield	Montgomery Reservoir	.106
Winchester	North Reservoir	.106
Gloucester	Wallace Reservoir	.108
Metropolitan Water District	Spot Pond	.109
Worcester	Bottomley Reservoir (Kettle Brook No. 4)	.111
	Leicester Reservoir (Lynde Reservoir)	.112
Fitchburg	Scott Reservoir	.114
Lynn	Birch Pond	.114
Weymouth	Great Pond	.115
Metropolitan Water District	Ware River at Coldbrook intake	.116
Stoughton	Muddy Pond	.116
West Newbury	Tap in Town—Groveland Supply	.118
Springfield	Ludlow Reservoir, unfiltered	.119
Pittsfield	Mill Brook Reservoir	.121
Great Barrington (Housatonic Water Works Company)	Long Pond, raw water	.122
Pittsfield	Ashley Lake	.124
Rutland	Muschopauge Lake	.125
Worcester	Quinapoxet Pond	.126
New Bedford	Little Quittacas Pond	.129
Cambridge	Fresh Pond	.132
Fall River	North Watuppa Lake	.132
Athol	Newton Reservoir	.134
Fitchburg	Falulah Brook	.134
Milford (Water Company)	Charles River, inlet to filters	.134
Metropolitan Water District	Hopkinton Reservoir	.136
Pittsfield	Farnham Reservoir	.136
North Andover	Great Pond	.138
Leominster	No-Town Reservoir	.139
Andover	Haggett's Pond	.142
Brookfield	Cooley Hill Reservoir	.142
Haverhill	Kenoza Lake	.142
Cambridge	Lower Hobbs Brook Reservoir	.144
Clinton	Heywood Pond	.145
Gardner	Crystal Lake	.145
Stockbridge (Water Company)	Lake Averic	.145
Metropolitan Water District	Ashland Reservoir	.148
	Lake Cochituate	.148
Peabody	Spring Pond	.148
Gloucester	Babson Reservoir	.151
Haverhill	Pentucket Lake	.151
Athol	Raw water at filter plant	.154
Chester	Horn Pond	.155
Marlborough	Milham Brook Reservoir	.155
Randolph	Great Pond, filtered water	.155
Wakefield	Crystal Lake	.156
Fitchburg	Lovell Reservoir	.158
Marlborough	Lake Williams	.159
New Bedford	Great Quittacas Pond	.164

Albuminoid Ammonia in Surface Waters—Concluded

(Parts per Million)

City or Town	Source	Albuminoid Ammonia 1940
Leominster	Haynes Reservoir	.165
Lynn	Breeds Pond	.166
Taunton	Elder's Pond	.166
Haverhill	Crystal Lake	.169
	Johnson's Pond	.171
Braintree	Great Pond, raw water	.173
Cambridge	Upper Hobbs Brook Reservoir	.173
Lynn	Walden Pond	.173
Peabody	Suntaug Lake	.182
Salem	Wenham Lake	.182
Randolph	Great Pond, raw water	.183
Metropolitan Water District	Framingham Reservoir No. 2	.185
Athol	Phillipston Reservoir	.185
Cambridge	Stony Brook Reservoir	.188
Ipswich	Dow's Brook Reservoir	.188
	Bull Brook Reservoir	.190
Norwood	Buckmaster Pond, raw water	.192
Northborough	Raw water	.193
Danvers	Middleton Pond	.204
Taunton	Assawompsett Pond	.204
Salem	Ipswich River at Pumping Station	.217
Haverhill	Millvale Reservoir	.220
Rockport	Cape Pond, raw water	.228
Winchester	Middle Reservoir	.230
Athol	Thousand Acre Meadow Brook	.253
Lawrence	Merrimack River	.263
North Brookfield	Doane Pond	.266
Fitchburg	Wachusett Lake	.280
Salem	Longham Reservoir	.293
Newburyport	Artichoke River	.306
Lynn	Hawkes Pond	.307
Pittsfield	Sand Wash Brook	.312
North Brookfield	North Pond	.377

Hardness of Surface Waters

(Parts per Million)

City or Town	Source	Hardness 1940
Plymouth	Great South Pond	4
Amherst (Water Company)	Atkins Pond	5
Hinsdale (Fire District)	Reservoir	5
Leominster	Fall Brook Reservoir	5
	Haynes Reservoir	5
	Morse Reservoir	5
Plymouth	Little South Pond	5
Fitchburg	Lovell Reservoir	6
Gloucester	Haskell Reservoir	6
Spencer	Shaw Pond	6
Wareham (Onset Fire District)	Jonathan Pond	6
Westfield	Montgomery Reservoir	6
	Granville Reservoir	6
Ashburnham	Upper Naukeag Lake	7
Fitchburg	Scott Reservoir	7
Gloucester	Wallace Reservoir	7
Leominster	No-Town Reservoir	7
Southbridge	Hatchet Brook Reservoir No. 5	7
Falmouth	Long Pond, before lime treatment	8
Fitchburg	Wachusett Lake	8
Gloucester	Dike's Brook Reservoir	8
Hingham (Water Company)	Accord Pond	8
Maynard	White Pond	8
Taunton	Assawompsett Pond	8
Abington	Big Sandy Pond	9
Brockton	Silver Lake	9
Fitchburg	Ashby Reservoir	9
	Meetinghouse Pond	9
New Bedford	Great Quittacas Pond	9
Orange	Coolidge Brook Reservoir	9
Southbridge	Hatchet Brook Reservoir No. 3	9
	Hatchet Brook Reservoir No. 4	9
Worcester	Upper Holden Reservoir	9
Athol	Newton Reservoir	10
Fitchburg	Falulah Brook	10
Taunton	Elder's Pond	10
Westfield	Winchell Reservoir	10
Worcester	Lower Holden Reservoir	10
Metropolitan Water District	Ware River at Coldbrook Intake	11
Amherst (Water Company)	Amethyst Brook—Intake Reservoir	11
Concord	Nagog Pond	11
Fall River	North Watuppa Lake	11
Manchester	Gravel Pond	11
Montague (Turners Falls Fire District)	Lake Pleasant	11
North Brookfield	North Pond	11

Hardness of Surface Waters—Continued
(Parts per Million)

City or Town	Source	Hardness 1940
Russell	Black Brook Reservoir	11
	Black Brook Reservoir, filtered	11
Springfield	Cobble Mountain Reservoir	11
Weymouth	Great Pond	11
Metropolitan Water District	Hopkinton Reservoir	12
Chester	Horn Pond	12
Clinton	Heywood Pond	12
Holyoke	Carmody Reservoir	12
New Bedford	Little Quittacas Pond	12
South Hadley (Fire District No. 1)	Leaping Well Reservoir	12
Springfield	Cobble Mountain Reservoir, filtered	12
Worcester	Pine Hill Reservoir	12
	Quinapoxet Pond	12
Athol	Raw water at filter plant	13
Clinton	Lower Lynde's Reservoir	13
Dalton (Fire District)	Egypt Brook Reservoir	13
Lincoln	Sandy Pond	13
Worcester	Mann Reservoir (Kettle Brook No. 2)	13
	Kendall Reservoir	13
Metropolitan Water District	Weston Reservoir	14
Holyoke	Hugh McLean Reservoir	14
Milford (Water Company)	Charles River, inlet to filter	14
Northborough	Cold Harbor Brook, final effluent	14
North Brookfield	Doane Pond	14
Pittsfield	Sand Wash Brook	14
Springfield	Ludlow Reservoir, filtered	14
Stoughton	Muddy Pond	14
Weymouth	Great Pond, filtered	14
Worcester	Leicester Reservoir (Lynde Reservoir)	14
Metropolitan Water District	Wachusett Reservoir, lower end	15
	Ashland Reservoir	15
Blandford (Fire District)	Freeland Brook	15
Brookfield	Cooley Hill Reservoir	15
Gloucester	Babson Reservoir	15
Hudson	Gates Pond	15
Pittsfield	Farnham Reservoir	15
Springfield	Ludlow Reservoir, unfiltered	15
Worcester	Kent Reservoir (Kettle Brook No. 1)	15
Metropolitan Water District	Wachusett Reservoir, upper end	16
Athol	Phillipston Reservoir	16
Dalton (Fire District)	Raw water	16
Falmouth	Long Pond, treated	16
Haverhill	Crystal Lake	16
Lynn	Birch Pond	16
Northfield (Water Company)	Minot Brook Reservoir	16
Palmer (Fire District No. 1)	Graves Brook, Lower Reservoir	16
Metropolitan Water District	Sudbury Reservoir	17
	Tap in Revere	17
Athol	Thousand Acre Meadow Brook	17
Barre	Reservoir	17
Chester	Austin Brook Reservoir	17
Monroe (Water District)	Phelps Brook Reservoir	17
Pittsfield	Ashley Lake	17
Winchester	Middle Reservoir	17
Worcester	Bottomly Reservoir (Kettle Brook No. 4)	17
Metropolitan Water District	Spot Pond	18
	Tap in State House	18
Danvers	Middleton Pond	18
Holyoke	White Reservoir	18
Huntington (Fire District)	Cold Brook Reservoir	18
Lawrence	Merrimack River	18
Northborough	Raw water	18
Rutland	Muschopauge Lake	18
Southborough	Sudbury Reservoir	18
Westhampton (Water Company)	Reservoir	18
Chicopee	Cooley Brook Reservoir, raw water	19
Northfield (Schools, Inc.)	Lower Reservoir on Louisiana Brook	19
Pittsfield	Mill Brook Reservoir	19
Williamsburg	Unquomonk Brook Reservoir	19
Metropolitan Water District	Tap in Quincy	20
Braintree	Great Pond, raw water	20
North Adams	Broad Brook	20
Northfield (Schools, Inc.)	Upper Reservoir on Louisiana Brook	20
Randolph	Great Pond, raw water	20
Metropolitan Water District	Framingham Reservoir No. 3	21
	Framingham Reservoir No. 2	21
	Chestnut Hill Reservoir	21
Gardner	Crystal Lake	21
Hadley (Water Supply District)	Hart's Brook Reservoir	21
Haverhill	Pentucket Lake	21
Lee (Berkshire Water Company)	Basin Pond Brook	21
Peabody	Spring Pond	21
	Suntaug Lake	21
Rockport	Cape Pond, raw water	21
Winchester	South Reservoir	21
Haverhill	Millvale Reservoir	22

Hardness of Surface Waters—Concluded

(Parts per Million)

City or Town	Source	Hardness 1940
Marlborough	Millham Brook Reservoir	22
Northampton	Middle Reservoir (Roberts Meadow Brook)	22
North Andover	Great Pond	22
Norwood	Buckmaster Pond, raw water	22
Randolph	Great Pond, filtered water	22
Winchester	North Reservoir	22
Andover	Haggett's Pond	23
Haverhill	Kenoza Lake	23
Ipswich	Dow's Brook Reservoir	23
South Hadley (Fire District No. 1)	Buttery Brook Reservoir	23
Chicopee	Morton Brook	24
Clinton	Spring Basin	24
Holyoke	Wright and Ashley Ponds	24
Lee (Berkshire Water Company)	Codding Brook Upper Reservoir	24
	Codding Brook Lower Reservoir	24
Northampton	Mountain Street Reservoir	24
Salem	Longham Reservoir	24
Holyoke	Whiting Street Reservoir	25
Norwood	Buckmaster Pond, filtered	25
Leominster	No-Town Reservoir and Simonds Pond, filtered	26
Marlborough	Lake Williams	26
Egremont (South Egremont Water Company)	Goodale Brook Reservoir	27
Haverhill	Johnson's Pond	27
Lynn	Breeds Pond	27
	Walden Pond	27
Newburyport	Artichoke River	27
Metropolitan Water District	Lake Cochituate	28
Cambridge	Upper Hobbs Brook Reservoir	28
	Lower Hobbs Brook Reservoir	28
Ipswich	Bull Brook Reservoir	28
Newburyport	Collecting Basin	28
Athol	Final effluent	29
Cambridge	Stony Brook Reservoir	29
Dalton (Fire District)	Windsor Reservoir	29
Newburyport	Mixed raw water	29
	Ground and Reservoir water, filtered	29
Wakefield	Crystal Lake	29
	Crystal Lake, filtered	29
West Newbury	Tap in Town—Groveland Supply	29
Milford (Water Company)	Dug wells and Charles River, filtered	30
Salem	Wenham Lake	30
West Stockbridge (Water Company)	East Mountain Reservoir	30
Chicopee	Cooley Brook Reservoir, filtered	31
Dalton (Fire District)	Filtered water	31
Salem	Wenham Lake, filtered	31
Ashfield (Water Company)	Highland Spring Reservoir	32
Braintree	Great Pond, filtered	32
Lawrence	Merrimack River, filtered	32
Hatfield	Running Gutter Brook Reservoir	34
Lynn	Hawkes Pond	36
Williamstown (Water Company)	Paul Brook	36
Rockport	Cape Pond, filtered	37
Great Barrington (Fire District)	East Mountain Reservoir	38
Greenfield	Filter plant, outlet of filter	38
Cheshire (Water Company)	Kitchen Brook Reservoir	39
Greenfield	Filter Plant, raw water	39
Cambridge	Fresh Pond	40
Deerfield (South Deerfield Water Supply District)	Roaring Brook Reservoir	40
Pittsfield	Ashley Reservoir	41
Shelburne (Falls Fire District)	Fox Brook Reservoir	41
Adams (Fire District)	Bassett Brook Reservoir	42
Lenox (Water Company)	Woolsey Reservoir	42
South Hadley (Fire District No. 2)	Elmer Brook, raw water	42
	Elmer Brook, filtered water	43
Sunderland (Water Company)	Saw Mill Brook Reservoir	43
Cambridge	Filter effluent	44
West Springfield	Bear Hole Brook Reservoir, filtered	46
	Bear Hole Brook Reservoir	47
Colrain (Griswoldville)	McClellan Brook Reservoir	49
Pittsfield	Sackett Reservoir	50
North Adams	Mount Williams Reservoir	52
Stockbridge (Water Company)	Lake Averic	53
Colrain (Fire District No. 1)	Mountain Brook Reservoir	55
Salem	Ipswich River at Pumping Station	59
Monterey (Water Company)	Reservoir	60
Lenox (Water Company)	Lower Root Reservoir	66
Williamstown (Water Company)	Rattlesnake Brook Reservoir	71
Great Barrington (Housatonic Water Works Company)	Long Pond, raw water	72
North Adams	Notch Brook Reservoir	72
Pittsfield	Hathaway Brook Reservoir	78
Great Barrington (Housatonic Water Works Company)	Long Pond, filtered	80
Williamstown (Water Company)	Sherman Spring Reservoir	96

Sanitary Protection of Public Water Supplies:

Rules and regulations are enforced by the Department through the Division of Sanitary Engineering under the following provisions:

Section 160 of Chapter 111 of the General Laws:
Rules and regulations for protecting the drainage areas and sources of water supply in cities and towns and fire and water districts and water companies.
Rules and regulations relative to cross connections between public water supplies and fire and industrial water supplies.

During the year 1940 the rules and regulations for protecting the drainage areas and sources of water supply of the Metropolitan Water District were readopted to include Quabbin Reservoir on the Swift River and intake reservoir on the Ware River and their tributaries.

The cities, towns and fire and water districts and water companies for which similar rules and regulations have been adopted by the Department up to the end of 1940 are as follows:

Abington and Rockland	1927
Adams (Fire District)	1921
Amherst (Water Company)	1931
Andover	1908
Ashburnham	1922
Ashfield (Water Company)	1923
Athol	1934
Attleboro	1926
Braintree	1913, 1926*
Brockton	1905, 1934
Cambridge	1899
Cheshire (Water Company)	1933
Chester (Fire District)	1914
Chicopee	1906
Clinton	1935
Cohasset (Water Company)	1923
Colrain (Fire District)	1932
Colrain (Griswoldville)	1934
Concord	1910
Dalton (Fire District)	1919
Danvers and Middleton	1901, 1920*
Deerfield (South Deerfield Water Supply District)	1932
Easthampton	1904
Egremont (South Egremont Water Company)	1932
Fall River	1907
Falmouth	1930
Fitchburg	1903, 1907, 1918, 1938*
Gardner	1910
Gloucester	1930
Great Barrington (Housatonic Water Works Company)	1929, 1936*
Great Barrington (Fire District)	1938
Greenfield	1904
Hatfield	1934
Haverhill	1921
Hingham and Hull (Hingham Water Company)	1912
Holden	1914, 1935*
Holyoke	1908, 1918*
Hudson	1929
Huntington (Fire District)	1938
Lakeville (State Sanatorium)	1926
Lee (Berkshire Water Company)	1919
Leicester (Cherry Valley and Rochdale Water District)	1914
Lenox (Water Company)	1933
Leominster	1919, 1927*
Lincoln and Concord	1903
Lynn	1907
Manchester	1934
Marlborough	1901
Maynard	1907
Medfield (State Hospital)	1922†
Metropolitan Water District	1925, 1940*
Milford (Water Company)	1924
Montague (Turners Falls Fire District)	1908, 1936*
New Bedford	1932
Newburyport	1921
Norfolk (State Hospital)	1926
Northampton	1904
North Andover	1912
Northborough	1905, 1934*
North Brookfield	1935
Norwood	1901
Orange	1939
Palmer (Fire District No. 1)	1933
Peabody	1922
Pittsfield	1903, 1909*
Plymouth	1908
Randolph and Holbrook	1926
Rockport	1902
Russell	1910
Rutland	1914, 1935*
Salem and Beverly	1901, 1938*
Scituate	1927
Southbridge (Southbridge Water Supply Company)	1931

*Readopted †Rescinded 1936

South Hadley (Fire District No. 1)	1937	Westborough	1929
Spencer	1934	WESTFIELD	1922
Springfield	1904, 1910*	West Springfield	1907
Stockbridge (Water Company)	1910	Weymouth	1903, 1935*
TAUNTON	1932	Williamsburg	1914
Wakefield	1904	Winchester	1909
		WORCESTER	1926

*Readopted

Acquisition of Land for Protection of Water Supplies

During the year 1940, 5 applications were received by the Department for the approval of the purchase or taking of lands for the protection of sources of public water supply. These proposed takings are shown in the following table:

CITY OR TOWN	Source of Supply	Location of Land	Area of Land in Proposed Taking (Acres)
Amherst (Water Company)	Amethyst Brook Reservoirs	Pelham	406.6±
Salem and Beverly	Wenham Lake	Beverly	5.7±
" " "	" "	"	5.0±
Spencer	Shaw Pond	Leicester	85.5±
Winchester	Tubular Wells	Winchester	15.2±

Consumption of Water

The water consumption records of the Metropolitan Water District, which are a reasonably good index of the consumption of water in the cities and towns of the Commonwealth, show that during each month of the year 1940 the water consumption was in excess of that for the same months of the year 1939 except for the months of July, August and November, this excess having varied from as little as 1.4 million gallons per day during the month of September, 1940, to as much as 9.7 million gallons per day in December, 1940. The decrease in water consumption during July, August and November, 1940, from the corresponding months of 1939 amounted to 2.0 million gallons per day, 0.6 million gallons per day, and 0.6 million gallons per day, respectively. The water consumption during the months of July, August and November, 1939, were very much increased by reason of the 1939 drought, and the water consumption for July, August and November, 1940, exceeded that of the same months in 1938 by 13.9 million gallons per day, 6.2 million gallons per day and 3.1 million gallons per day, respectively. The high water consumptions during the summer of 1940 were caused by relatively dry months which, though failing to result in water shortages, caused the general lowering of the ground water levels in certain portions of the State and, had the deficiency in rainfall continued, might have resulted in serious shortage.

The average daily water consumption in the various cities and towns where records are kept and submitted to the Department, the population and the estimated per capita water consumption in these cities and towns are shown in the following table:

Average Daily Consumption of Water in Various Cities and Towns in 1940

City or Town	Population	Gallons	Gallons per Inhabitant
Metropolitan Water District			
Arlington	40,013	2,166,900	54
Belmont	26,867	1,523,500	57
Boston	770,816	94,830,500	123
Chelsea	41,259	3,439,000	83
Everett	46,784	4,867,200	104
Lexington	13,187	659,900	50
Malden	58,010	4,202,300	72
Medford	63,083	3,433,300	54
Melrose	25,333	1,392,600	55
Milton	18,708	976,300	52
Nahant	1,835	199,100	109
Quincy	75,810	4,920,000	65
Revere	34,405	2,090,500	61
Somerville	102,177	9,337,000	91
Stoneham	10,765	658,000	61
Swampscott	10,761	834,400	78
Watertown	35,427	2,354,200	66
Winthrop	16,768	1,282,900	77
Abington and Rockland	13,795	688,000	50
Acton	2,701	111,000	41
Acushnet	4,145	105,000	25
Agawam	7,842	380,600	49
Amesbury	10,862	745,700	69
Amherst	6,410	617,000	96
Andover	11,122	1,132,900	102
Ashburnham	2,255	94,900	42
Ashland	–	–	–
Athol	11,180	550,200	49
Attleboro	22,071	1,230,000	56
Avon	2,335	139,000	60
Ayer	3,572	190,900	53
Barnstable	8,333	770,000	92
Bedford	3,807	144,800	38
Belchertown	3,503	32,000	9
Bellingham	2,979	59,000	20
Beverly	25,537	1,731,000	68
Billerica	7,933	323,500	41
Blandford	479	20,000	41
Braintree	16,378	1,426,000	87
Bridgewater	8,902	221,000	25
Brockton	62,343	4,932,000	79
Brookline	49,786	4,864,000	98
Bourne	3,315	137,000	41
Cambridge	110,879	12,272,000	111
Canton	6,381	672,000	105
Chatham	2,136	108,000	51
Chelmsford	8,077	305,000	38
Chicopee	41,664	3,471,600	83
Clinton	12,440	866,900	70
Cohasset	3,111	313,000	101
Concord	7,972	492,960	62
Danvers and Middleton	16,527	980,000	59
Dartmouth	9,011	245,000	27
Dedham	15,508	1,104,000	71
Douglas	2,617	280,800	107
Dracut	7,339	240,300	33
Dudley	–	–	–
Duxbury	2,359	273,790	116
East Bridgewater	3,832	188,000	49
East Brookfield	1,106	68,250	67
Easthampton	10,316	829,700	80
East Longmeadow	3,403	106,800	31
Easton	5,135	388,000	76
Edgartown	1,370	154,000	48
Fairhaven	10,938	528,000	48
Fall River	115,428	6,745,570	58
Falmouth	6,878	957,900	139
Fitchburg	41,824	5,320,000	127
Foxborough	6,303	645,000	102
Framingham	23,214	1,461,000	63
Franklin	7,303	436,000	60
Gardner	20,206	1,011,900	50
Georgetown	1,803	38,000	21
Gloucester	24,046	1,852,000	77
Grafton	7,457	157,000	21
Great Barrington	5,824	706,900	121
Greenfield	15,672	1,379,100	88
Groton	2,550	328,000	129
Groveland	2,122	41,000	19
Hamilton	2,037	62,900	31
Hanover	2,875	129,000	45
Hanson and Pembroke	4,288	168,000	39
Harwich	2,535	55,900	22
Haverhill	46,752	3,928,000	84
Hingham and Hull	10,170	1,258,000	124
Holden	3,924	72,000	18
Holliston	3,000	106,000	35
Holyoke	53,750	7,465,000	139
Hopkinton	–	–	–
Hudson	8,042	428,200	53
Ipswich	6,348	328,000	52
Kingston	2,783	265,890	96
Lancaster	2,963	120,500	41
Lawrence	84,523	4,335,000	51
Leicester	–	–	–
Lenox	–	–	–
Leominster	22,226	2,276,200	102
Lincoln	–	–	–
Littleton	1,651	88,500	54
Longmeadow	5,790	392,600	68
Lowell	101,389	5,597,000	55
Ludlow	8,181	289,000	35
Lynn	98,123	7,729,100	79
Manchester	2,472	293,800	119
Mansfield	6,530	615,900	94
Marblehead	10,856	815,500	75
Marion	2,030	211,000	104
Marlborough	15,154	901,900	60
Marshfield	–	–	–
Mattapoisett	1,608	100,000	62
Maynard	6,812	322,650	47
Medfield	4,384	89,000	20
Medway	3,297	251,000	76
Merrimac	2,320	172,100	74
Methuen	21,880	1,094,000	50
Middleborough	9,032	310,200	34
Milford and Hopedale	18,501	805,300	44
Millbury	6,983	296,000	42
Millis	2,278	183,000	80
Montague and Erving	8,910	767,500	86
Nantucket	3,401	541,700	159
Natick	13,851	905,000	65
Needham	12,445	738,900	59
New Bedford	110,341	9,157,000	83
Newburyport	13,916	1,569,400	113
Newton	69,873	5,130,000	73
North Adams	22,213	3,184,100	143
North Andover	7,524	469,200	62
North Attleborough	10,359	828,600	80
Northbridge	10,242	745,000	73
Northampton	24,794	3,083,000	124
North Brookfield	3,304	401,100	122
North Reading	2,886	439,200	152
Norton	3,107	203,000	65
Norwood	15,383	1,165,000	76
Oak Bluffs	1,584	136,000	86
Oxford	4,623	167,000	36
Palmer	9,149	360,000	39
Paxton	791	14,100	18
Peabody	21,711	2,526,000	116
Pepperell	3,114	258,300	83
Pittsfield	49,684	6,870,000	138
Plainville	1,302	121,100	93
Plymouth	13,100	1,628,000	124
Provincetown	3,668	405,890	111
Randolph and Holbrook	10,964	649,000	59
Reading	10,866	671,500	62
Rockport	3,556	348,600	98
Rutland	2,181	247,800	114
Salem	41,213	3,951,000	96
Salisbury	2,376	281,900	119
Saugus	14,825	665,000	45
Scituate	–	–	–
Sharon	3,737	406,000	109
Shelburne	1,636	94,900	58
Shirley	2,608	97,400	37
Shrewsbury	7,586	356,800	47

Average Daily Consumption of Water in Various Cities and Towns in 1940
—Concluded

City or Town	Population	Gallons	Gallons per Inhabitant	City or Town	Population	Gallons	Gallons per Inhabitant
Somerset	5,873	262,800	45	Wayland	3,505	364,000	104
Southborough	2,231	149,000	67	Webster	13,186	705,100	53
Southbridge	–	–	–	Wellesley	15,127	1,341,000	89
Southwick	1,579	34,500	22	West Bridgewater	3,247	187,000	58
SPRINGFIELD	149,554	15,639,000	105	West Brookfield	1,387	90,900	65
Sterling	1,713	221,000	13	WESTFIELD	18,793	2,063,000	110
Stockbridge	1,815	251,000	138	Westford	3,830	113,000	30
Stoughton	8,632	607,000	70	Weston	3,590	229,000	64
Sturbridge	2,227	69,200	31	West Newbury	1,515	20,000	13
Sudbury	1,754	18,200	104	West Springfield	17,135	1,318,000	77
TAUNTON	37,395	2,598,000	69	Weymouth	23,868	1,311,800	55
Tisbury	1,966	267,500	136	Whitman	7,759	313,000	40
Townsend	2,065	132,300	64	Wilbraham	3,041	55,800	18
Uxbridge	6,417	312,900	49	Williamsburg	1,684	89,000	53
Wakefield	16,223	761,700	47	Wilmington	4,645	2,234,200	48
Walpole	7,443	831,000	112	Winchester	15,081	1,000,000	66
WALTHAM	40,020	2,721,000	68	WOBURN	19,751	1,504,000	76
Ware	7,557	383,900	51	WORCESTER	193,694	17,236,000	89
Wareham	6,364	566,000	89	Wrentham	4,674	195,400	42
Warren	3,531	93,900	27	Yarmouth	2,286	103,000	45

Climatological Data

The general weather conditions from October to December, 1939, inclusive, were practically normal for temperature and 2.10 inches below normal for precipitation. There were only small amounts of snow, generally followed by rain, until the end of December, when 3.0 inches or more fell and remained on the ground, due to the cold weather at this time.

January was the coldest since 1920; there were only 9 days during the month when the maximum daily temperature was over 32° in the vicinity of Boston, while in the central part of the State there were only 5 days and in the western section but 3 days. No extreme cold occurred during the month, the minimum temperature in the vicinity of Boston being 8°, central portion —3° and the western portion —11°. The precipitation, all in the form of snow, was about 33 per cent less than normal and the average total depth for the month was 8.3 inches which is about 30 per cent less than the average for this vicinity.

February temperature was somewhat warmer than normal. The severe northeast snow storm or blizzard of the 14th and 15th caused the loss of some lives and serious transportation conditions. Depths of 10 to 18 inches were reported. The total snowfall for the month was about 92 per cent in excess of the normal in the eastern portion of the State and 10 per cent in excess in the central. The water content of this snow was about 4.9 inches or 37½ per cent more than the normal.

The weather in March was much colder than usual and the precipitation somewhat above the normal. Minimum temperatures in the vicinity of Boston were below freezing on all except 5 days and there were no warm days except at the end of the month. In the easterly section of the State but little snow was added to the ground cover, but in the central and western sections about 20 per cent more than the normal was recorded. At the end of March the total snowfall for the climatic year which began October 1, 1939, was 35 inches as recorded at Amherst, the normal being 45.5 inches; the precipitation for this period was 1.93 inches less than the normal.

April was recorded at many stations as one of the coldest and wettest on their records; seasonable temperatures occurred up to the 13th, but from that date to the 29th subnormal temperatures persisted. The precipitation was 66 per cent in excess of the normal. Snowfall occurred as late as the 22nd; the total for the month in the central portion of the State was recorded as 6.5 inches, making the total for the climatic year 41.5 inches, the normal being 47.7 inches. The run-off as measured from the Wachusett watershed, due to the absence of any extreme minimum temperatures and the excessive rainfall, was the largest for the month of April since the record started in 1897.

The month of May was in general a continuation of the unfavorable spring weather of the preceding 2 months. The temperature was somewhat below the normal, the sunshine was less than half the possible amount and was near the May record for the past 50 years. The rainfall was 45 per cent more than the normal and very heavy rains occurred at the end of the month. The total precipitation for the months of February, March, April and May was 37 per cent greater than the accumulated normals for these months, and for the climatic year there was on June 1st an excess of 2.14 inches.

The temperature during June was in reverse as the first part of the month was warm while the last 10 days were the coldest on record at most stations, and showers occurred nearly every day during this period. The total rainfall for the month, while about 37 per cent deficient, was well distributed.

The temperature for the first 2 weeks of July was low, while the last half of the month was unusually hot with high humidity, making most uncomfortable weather. These extremes made the mean temperature for the month practically normal. Rain, mostly as showers, occurred at frequent intervals and the total precipitation for the month was slightly over the normal.

August was generally cold and dry. The Amherst and the U. S. Weather Bureau records show subnormal temperatures the latter part of the month as the lowest recorded during the past 50 years. The mean temperature for the month in the vicinity of Boston was 1.5° less than normal, central section 1.7° and in the western section about 1°. The rainfall total of 1.50 inches was about 64 per cent less than the normal and the lowest since 1889, except for August, 1907, when the total was only 1.30 inches. The deficiency in rainfall for the months of June, July and August was 3.70 inches. The sunshine was about 11 per cent more than the normal and the relative humidity was slightly less than the mean.

The September temperature was slightly below normal and there were killing frosts in most of the low-lying districts. The rainfall was quite unevenly distributed with 3 areas that received less than 2 inches, the largest in the Connecticut River Valley; the southeastern section including the Cape, also the northwest corner received from 4.00 to about 6.50 inches. The average for the State was about 21.5 per cent less than the normal. For the climatic year ending September 30 there was a deficiency of 2.34 inches, which was practically the amount of excess on June 1st.

In general October was clear, cool and very dry; the mean temperature was about 3° less than the normal and there were 2 exceptionally cold periods towards the end of the month with minimum temperatures of 19°. This low reading has only been exceeded twice in this month during the past 50 years. The hours of bright sunshine exceeded the normal by about 26 per cent. The rainfall deficiency was 2.22 inches; the total deficiency for the months June to October, inclusive, was 6.70 inches. Stream flows were quite low and some water supplies having insufficient storage, also some wells in the central and western sections, were threatened with water shortage.

The weather for November was somewhat warmer and decidedly more wet than normal. The hours of bright sunshine were 67 per cent of the normal. The average precipitation for the State was 6.96 inches or about 80 per cent more than the normal. There were 2 large areas that received from 7 to 8 inches, and considerably over three-quarters of the State area received from 6 to 7 inches. This precipitation, after the 25th of the month, was in the form of snow where, in the central portion of the State, about 13.0 inches were recorded, of which 11 inches occurred on the 26th and 27th. This is a very heavy snowfall for November and has only been exceeded once in the past 50 years in 1938 when 13.5 inches were recorded.

The mean temperature for the month of December was warmer than the average, due to the unusually warm last 8 days of the month. The precipitation was 24 per cent less than the average and the total snowfall about 3.5 inches or half the average for this month in this vicinity, while in the central part of the State a total of 5 inches was recorded, which is about 60 per cent of the average.

The monthly normal and actual mean temperatures for the vicinity of Boston for 1940 are shown in the following table:

Degrees Fahrenheit

	Normal	1940		Normal	1940
January	27.9	23.0	July	71.7	71.6
February	28.8	29.6	August	69.9	68.4
March	35.6	33.1	September	63.2	63.3
April	46.4	43.6	October	53.6	50.6
May	57.1	56.2	November	42.0	42.9
June	66.5	65.1	December	32.5	34.3

The following table has been prepared to show the monthly mean and the maximum and minimum temperature for each month in 1940 for Boston, Worcester, Amherst and Pittsfield:

Temperatures

(Degrees Fahrenheit)

	Boston			Worcester			Amherst			Pittsfield		
1940	Mean	Max.	Min.	Mean	Max.	Min.	Mean	Max.	Min.	Mean	Max.	Min.
January	23	52	8	20	44	2	19	42	—3	15	39	—3
February	30	47	10	27	45	3	27	46	—6	23	43	—7
March	33	60	14	30	57	4	30	59	5	26	53	2
April	44	75	26	41	75	18	42	74	20	41	74	17
May	56	75	43	55	78	34	57	82	33	58	80	33
June	65	90	46	64	89	42	65	89	39	64	91	37
July	72	95	55	71	93	45	71	94	46	71	96	46
August	68	86	46	66	88	40	67	89	34	67	90	35
September	63	86	42	60	85	34	60	85	30	59	87	33
October	51	77	28	47	75	19	47	76	19	46	74	19
November	43	71	17	39	66	5	39	69	11	38	67	9
December	34	58	2	30	59	—9	29	47	—10	30	49	—6
Year	49	95	2	46	93	—9	46	94	—10	45	96	—7
Mean and Extremes	50	104	—18	48	102	—15	47	104	—26	46	101	—17

Rainfall

The average rainfall for the year 1940 as recorded at 7 long-term well-distributed rainfall stations throughout the State under the general supervision of this Division was 44.42 inches, which is practically normal. There were deficiences in January, June, August, September, October and December. The greatest deficiency in any one month during the year occurred in August, amounting to 2.61 inches. The greatest excess occurred in the month of November, amounting to 3.10 inches; the considerable excess in April and May prevented what might have been a serious water shortage by October.

The following table shows the normal rainfall as deduced from the records of the 7 long-term stations referred to herein, each record exceeding 65 years in length, also the rainfall for the year 1940 and the excess or deficiency during each month as compared with the normal.

Month	Normal Rainfall (inches)	Rainfall in 1940 (inches)	Excess or Deficiency in 1940 (inches)
January	3.80	2.53	—1.27
February	3.55	4.88	+1.33
March	3.98	4.09	+0.11
April	3.75	6.22	+2.47
May	3.55	5.15	+1.60
June	3.40	2.15	—1.25
July	3.71	3.87	+0.16
August	4.11	1.50	—2.61
September	3.63	2.85	—0.78
October	3.64	1.42	—2.22
November	3.86	6.96	+3.10
December	3.67	2.80	—0.87
Totals	44.65	44.42	—0.23

Sudbury River

The average yield of the Sudbury River watershed during the year 1940 was 1.505 cubic feet per second or 973,000 gallons per day per square mile of drainage area. The normal flow of the stream for the past 66 years during which records have been kept by this Department is 1.522 cubic feet per second or 984,000 gallons per day per square mile. There were deficiencies in January, February, March, August, September, October and December. The greatest deficiency occurred in February, amounting to 945,000 gallons per day per square mile. Excesses occurred in April, May, June, July and November. The yield for the month of April was the largest for that month since 1901. The excess for April nearly equalled the accumulative deficiencies for the months of January, February and March. The average daily yield for the 6 driest months, June to November inclusive, was 326,000 gallons per day per square mile or 80.8 per cent of the normal.

The following table shows the relation between the average daily yield of the Sudbury River per square mile in each month of the year 1940 and the normal yield of the river during the past 66 years. The drainage area of the Sudbury River at the point of measurement is 75.2 square miles.

Table showing the Average Daily Yield of the Sudbury River for Each Month in the Year 1940; in Cubic Feet per Second per Square Mile of Drainage Area, and in Million Gallons per Day per Square Mile of Drainage Area; also Departure from the Normal.

MONTH	NORMAL YIELD		ACTUAL YIELD IN 1940		EXCESS OR DEFICIENCY	
	Cubic Feet per Second per Square Mile	Million Gallons per Day per Square Mile	Cubic Feet per Second per Square Mile	Million Gallons per Day per Square Mile	Cubic Feet per Second per Square Mile	Million Gallons per Day per Square Mile
January	1.777	1.149	.798	.516	— .979	— .633
February	2.276	1.471	.815	.526	—1.461	— .945
March	4.133	2.671	3.391	2.191	— .742	— .480
April	3.165	2.046	6.140	3.969	+2.975	+1.923
May	1.676	1.083	2.406	1.555	+ .730	+ .472
June	.826	.534	1.256	.812	+ .430	+ .278
July	.367	.237	.707	.457	+ .340	+ .220
August	.319	.206	—.230	—.149	— .549	— .355
September	.448	.289	—.027	—.017	— .475	— .306
October	.607	.392	—.140	—.091	— .747	— .483
November	1.196	.773	1.499	.969	+ .303	+ .196
December	1.530	.989	1.499	.969	— .031	— .020
Average for whole year .	1.522	.984	1.505	.973	— .017	— .011

The rainfall on the Sudbury River watershed and the total yield expressed in inches in depth (inches of rainfall collected) for each of the past 6 years, 1935 to 1940, inclusive, together with the average for the period of 66 years, are given in the following table.

Rainfall, in Inches, received and collected on the Sudbury River Drainage Area

MONTH	1935			1936			1937			1938		
	Rainfall	Rainfall collected	Per Cent collected	Rainfall	Rainfall collected	Per Cent collected	Rainfall	Rainfall collected	Per Cent collected	Rainfall	Rainfall collected	Per Cent collected
January .	7.01	3.339	47.7	8.10	2.847	35.1	4.67	4.032	86.4	4.72	3.280	69.5
February .	3.25	2.269	69.9	4.12	1.363	33.1	2.38	2.386	100.2	2.38	2.721	114.5
March .	1.82	4.877	267.5	9.68	11.551	119.3	3.60	3.023	84.0	2.73	2.531	92.6
April . .	5.08	4.516	88.8	3.28	4.011	122.4	4.84	3.157	65.2	3.07	2.036	66.3
May . .	2.40	1.587	66.1	2.62	1.448	55.2	3.82	2.430	63.6	4.24	1.662	39.2
June . .	5.41	1.883	34.8	2.41	.326	13.5	4.24	1.375	32.4	7.63	2.266	29.7
July . .	1.83	.171	9.3	1.18	—.168	—14.3	1.51	.320	21.2	11.31	6.149	54.4
August .	1.63	—.150	—9.2	5.17	.021	0.4	4.60	.224	4.9	4.43	2.041	46.1
September .	3.93	.187	4.8	5.57	.417	7.5	3.16	.292	9.2	9.28	3.929	42.3
October .	0.53	—.182	—34.2	2.09	.620	29.6	3.60	.631	17.5	1.94	1.707	88.0
November .	4.98	.751	15.1	1.66	.510	30.8	6.41	2.326	36.3	3.04	1.530	50.3
December .	1.03	.665	64.7	8.65	5.116	59.2	3.93	3.414	86.9	3.63	3.470	95.6
Totals and averages .	38.90	19.913	51.2	54.53	28.062	51.5	46.76	23.610	50.5	58.40	33.322	57.1

Rainfall, in Inches, received and collected on the Sudbury River Drainage Area—Cont.

Month	1939			1940			Mean for Sixty-six Years (1875-1940)		
	Rainfall	Rainfall collected	Per Cent collected	Rainfall	Rainfall collected	Per Cent collected	Rainfall	Rainfall collected	Per Cent collected
January	2.52	1.573	62.3	2.46	.920	37.4	4.01	2.049	51.1
February	4.35	2.608	60.0	6.11	.879	14.4	3.96	2.390	60.4
March	4.84	4.213	87.1	4.08	3.909	95.9	4.28	4.765	111.3
April	4.58	5.231	111.1	5.66	6.850	120.9	3.72	3.531	94.8
May	1.59	1.178	74.1	4.50	2.774	61.6	3.22	1.932	60.0
June	3.64	.336	9.2	2.07	1.401	67.7	3.38	.921	27.2
July	2.01	—.157	—7.8	4.35	.815	18.7	3.60	.423	11.8
August	4.21	—.033	—0.8	1.93	—.265	—13.7	3.80	.368	9.7
September	1.90	—.028	—1.5	3.54	—.030	— 0.8	3.69	.500	13.6
October	5.20	.317	6.1	1.25	—.162	—13.0	3.51	.699	69.9
November	1.07	.557	51.8	6.83	1.672	24.5	3.79	1.335	35.3
December	3.25	.669	20.6	2.75	1.728	62.8	3.75	1.765	47.1
Totals and averages	39.16	16.464	42.0	45.53	20.491	45.0	44.71	20.678	46.3

The following table gives the record of the Sudbury River in gallons per day per square mile for each of the past 6 years and the mean for the past 66 years:

Yield of the Sudbury River Drainage Area in Gallons per Day per Square Mile[1]

Month	1935	1936	1937	1938	1939	1940	Mean for Sixty-six Years, 1875-1940
January	1,872,000	1,596,000	2,260,000	1,839,000	882,000	516,000	1,149,000
February	1,408,000	817,000	1,481,000	1,688,000	1,619,000	526,000	1,471,000
March	2,734,000	6,476,000	1,695,000	1,419,000	2,362,000	2,191,000	2,671,000
April	2,620,000	2,327,000	1,829,000	1,180,000	3,030,000	3,969,000	2,046,000
May	890,000	812,000	1,362,000	932,000	661,000	1,555,000	1,083,000
June	1,091,000	189,000	796,000	1,313,000	195,000	812,000	534,000
July	96,000	—94,000	179,000	3,447,000	—88,000	457,000	237,000
August	—84,000	12,000	126,000	1,144,000	—18,000	—149,000	206,000
September	108,000	241,000	169,000	2,276,000	—16,000	—17,000	289,000
October	—102,000	348,000	354,000	957,000	178,000	—91,000	392,000
November	435,000	295,000	1,348,000	886,000	323,000	969,000	773,000
December	373,000	2,868,000	1,914,000	1,945,000	375,000	969,000	989,000
Average for whole year	948,000	1,332,000	1,124,000	1,587,000	784,000	973,000	984,000
Average for driest six months	136,100	163,900	491,000	1,392,000	94,000	326,000	403,000

[1]The drainage area of the Sudbury River used in making up these records included water surfaces amounting to about 2 per cent of the whole area from 1875 to 1878, inclusive, subsequently increasing by the construction of storage reservoirs to about 3 per cent in 1879, to 3.5 per cent in 1885, to 4 per cent in 1894, and to 6.5 per cent in 1898. The drainage area also contains extensive areas of swamp land, which, though covered with water at times, are not included in the above percentages of water surfaces.

Nashua River

The average yield of the South Branch of the Nashua River at the outlet of Wachusett Reservoir in Clinton during the year 1940 was 1.853 cubic feet per second, which is 1,198,000 gallons per day per square mile of drainage area or 6.5 per cent more than the normal. The average yield for the 6 driest months, July to December, inclusive, was 510,000 gallons per day per square mile or 13.7 per cent less than the normal for the 6 driest months. There were deficiencies in all but the 4 months, April, May, June and July; the excess for these 4 months was 31.5 per cent greater than the combined deficiencies of the other 8 months. The April yield exceeded any previous record for this month.

The following table shows the normal yield of the South Branch of the Nashua River by months for the past 44 years, the actual yield in the year 1940 and the excess or deficiency in each month. The drainage area of the Nashua River above the point of measurement was 119 square miles from 1897 to 1907, 118.19 square miles from 1908 to 1913, inclusive, from January 1, 1914 to July 1, 1937, 108.84 square miles. July 1, 1937 the drainage area was further reduced 1.15 square miles leaving the net drainage area 107.69 square miles.

Table showing the Average Daily Yield of the South Branch of the Nashua River for Each Month in the Year 1940, in Cubic Feet per Second per Square Mile of Drainage Area, and in Million Gallons per Day per Square Mile of Drainage Area; also Departure from the Normal.

Month	Normal Yield		Actual Yield in 1940		Excess or Deficiency	
	Cubic Feet per Second per Square Mile	Million Gallons per Day per Square Mile	Cubic Feet per Second per Square Mile	Million Gallons per Day per Square Mile	Cubic Feet per Second per Square Mile	Million Gallons per Day per Square Mile
January	1.929	1.247	1.120	.724	— .809	— .523
February	1.989	1.285	1.179	.762	— .810	— .523
March	3.992	2.580	2.431	1.571	—1.561	—1.009
April	3.689	2.381	8.209	5.306	+4.520	+2.922
May	2.018	1.304	3.001	1.940	+ .983	+ .636
June	1.303	.842	1.645	1.063	+ .342	+ .221
July	.765	.494	.864	.559	+ .099	+ .065
August	.630	.407	.317	.205	— .313	— .202
September	.746	.482	.427	.276	— .319	— .206
October	.768	.496	.298	.193	— .470	— .303
November	1.292	.835	1.281	.828	— .011	— .007
December	1.785	1.153	1.555	1.005	— .230	— .148
Average for whole year	1.740	1.125	1.853	1.198	+ .113	+ .073

The rainfall on the Nashua River watershed and the total yield expressed in inches in depth upon the watershed (inches of rainfall collected) for each of the past 6 years, 1935 to 1940, inclusive, together with the average for the past 44 years, are given in the following table:

Rainfall, in Inches, received and collected on the Nashua River Drainage Area

Month	1935			1936			1937			1938		
	Rainfall	Rainfall collected	Per Cent collected	Rainfall	Rainfall collected	Per cent collected	Rainfall	Rainfall collected	Per Cent collected	Rainfall	Rainfall collected	Per Cent collected
January	6.80	4.014	59.0	8.03	3.304	41.2	5.36	4.239	79.0	4.92	3.538	71.9
February	3.63	2.332	64.2	2.89	1.418	49.1	2.33	2.519	108.1	2.59	3.412	131.5
March	2.19	4.927	225.5	11.04	12.635	114.5	3.63	2.786	76.9	2.88	3.073	106.8
April	4.09	3.971	97.1	3.68	4.475	121.5	5.49	4.018	73.2	3.35	2.675	79.9
May	2.67	1.997	74.9	3.45	2.249	65.1	4.23	3.129	74.0	3.70	2.038	55.1
June	5.89	2.308	39.2	2.84	.914	32.2	4.27	1.705	39.9	7.41	2.348	31.7
July	2.81	.891	31.7	2.26	.540	23.8	1.77	.589	33.2	9.47	4.363	46.1
August	2.13	.367	17.2	5.35	.636	11.9	4.62	.715	15.5	3.26	1.545	47.3
September	4.63	.678	14.6	4.71	.583	12.4	3.90	.681	17.5	11.09	5.863	52.9
October	.73	.352	48.1	3.18	1.037	32.5	4.47	.961	21.5	2.44	1.918	78.6
November	4.67	1.092	23.4	1.68	.709	42.2	8.44	3.999	47.4	3.61	1.785	49.4
December	1.18	.847	71.9	8.19	4.069	49.7	3.58	3.169	88.6	3.37	4.403	130.7
Totals and averages	41.42	23.776	57.4	57.30	32.569	56.8	52.09	28.510	54.7	58.09	36.961	63.6

Rainfall, in Inches, received and collected on the Nashua River Drainage Area—Cont.

Month	1939			1940			Mean for Forty-four Years 1897-1940		
	Rainfall	Rainfall collected	Per Cent collected	Rainfall	Rainfall collected	Per Cent collected	Rainfall	Rainfall collected	Per Cent collected
January	3.00	2.323	77.4	3.50	1.292	36.9	3.87	2.224	57.5
February	4.16	2.478	59.6	4.58	1.272	27.8	3.74	2.088	55.7
March	5.16	4.931	95.6	4.59	2.803	61.0	4.15	4.603	111.0
April	4.56	6.282	137.9	6.12	9.159	149.6	3.97	4.116	103.6
May	2.00	1.865	93.4	5.49	3.460	63.0	3.35	2.326	69.4
June	3.57	1.134	31.8	2.50	1.836	73.6	3.89	1.453	37.4
July	1.68	.542	32.2	4.55	.997	21.9	3.94	.881	22.4
August	3.95	.584	14.8	1.60	.365	22.9	3.96	.726	18.3
September	2.62	.397	15.1	2.47	.475	19.2	4.08	.833	20.4
October	4.52	.584	12.9	1.13	.344	30.6	3.24	.886	27.3
November	1.08	.813	75.1	7.15	1.429	20.0	3.74	1.441	38.5
December	3.37	1.088	32.3	2.90	1.793	61.9	3.88	2.057	53.1
Totals and averages	39.67	23.021	58.0	46.58	25.225	54.2	45.81	23.634	51.6

The following table gives the record of the yield of the Nashua River watershed in gallons per day per square mile for each of the past 6 years and the mean for the past 44 years:

Yield of the Nashua River Drainage Area in Gallons per Day per Square Mile[1]

Month	1935	1936	1937	1938	1939	1940	Mean for Forty-four Years, 1897-1940
January	2,250,000	1,853,000	2,376,000	1,983,000	1,302,000	724,000	1,247,000
February	1,447,000	850,000	1,563,000	2,118,000	1,538,000	762,000	1,285,000
March	2,762,000	7,083,000	1,562,000	1,723,000	2,764,000	1,571,000	2,580,000
April	2,303,000	2,596,000	2,331,000	1,550,000	3,639,000	5,306,000	2,384,000
May	1,119,000	1,261,000	1,754,000	1,142,000	1,045,000	1,940,000	1,304,000
June	1,337,000	530,000	988,000	1,360,000	657,000	1,063,000	842,000
July	500,000	303,000	330,000	2,446,000	304,000	559,000	494,000
August	206,000	357,000	401,000	866,000	327,000	205,000	407,000
September	392,000	337,000	394,000	3,396,000	230,000	276,000	482,000
October	198,000	581,000	539,000	1,075,000	328,000	193,000	496,000
November	633,000	411,000	2,317,000	1,034,000	471,000	828,000	835,000
December	475,000	2,281,000	1,776,000	2,468,000	610,000	1,005,000	1,153,000
Average for whole year	1,132,000	1,547,000	1,357,000	1,760,000	1,096,000	1,198,000	1,125,000
Average for driest six months	399,150	419,700	737,000	1,515,000	379,000	510,000	591,000

[1]The drainage area used in making up these records included water surfaces amounting to 2.2 per cent of the whole area from 1897 to 1902, inclusive, to 2.4 per cent in 1903, to 3.6 per cent in 1904, to 4.1 per cent in 1905, to 5.1 per cent in 1906, to 6 per cent in 1907, to 7 per cent in 1908, 1909 and 1910, to 6.5 per cent in 1911, to 6.8 per cent in 1912, to 7 per cent in 1913, to 7.4 per cent in 1914 and 1915, to 7.6 per cent in 1916, to 7.4 per cent in 1917 and 1918, to 7.5 per cent in 1919, 1920, 1921 and 1922, to 7.4 per cent in 1923 and 1924, to 6.4 per cent in 1925, to 5.9 per cent in 1926, to 5.7 per cent in 1927, to 7.6 per cent in 1928, to 7.4 per cent in 1929, to 5.6 per cent in 1930, to 6 per cent in 1931, to 7.3 per cent in 1932, to 7.6 per cent in 1933, to 7.6 per cent in 1934, to 7.6 per cent in 1935, to 7.4 per cent in 1936, 7.6 per cent in 1937, 7.8 per cent in 1938, 7.4 per cent in 1939 and 7.0 per cent in 1940.

Merrimack River

The Merrimack River is the second largest stream in the State of Massachusetts. It rises in the White Mountains in the State of New Hampshire and flows southerly through the central part of that state until it enters Massachusetts, where it turns to the east and flows in a general northeasterly direction the remainder of its course to the sea. The total length of its watershed from its extreme northerly limits in the mountains of northern New Hampshire to its extreme southerly limits in the hills of Hopkinton, Massachusetts, is about 137 miles and its extreme width is about 66 miles. The total drainage area above the mouth of the river at Newburyport comprises about 5,000 square miles, of which about ¼ or 1,250 square miles are within the limits of Massachusetts and ¾ or 3,750 square miles are within the State of New Hampshire.

Records of the flow of the Merrimack River have been kept continuously at Lawrence in the office of the Essex Company since 1880. The original drainage area used for the river at that point was 4,663 square miles and included 118.19 square miles tributary to the South Branch of the Nashua River at the Wachusett Dam in Clinton, from which the Metropolitan Water District is supplied and also in part the city of Worcester; 75.2 square miles on the Sudbury River; and 18 square miles tributary to Lake Cochituate. Overflows or wastage from these areas are included in the measured flow at Lawrence but are deducted before the figures herewith given are computed. The net drainage areas used in the past were 4,567 square miles from 1880, 4,570 square miles from 1891 to 1897, inclusive, and 4,452 square miles from 1898 to 1935, inclusive. The Merrimack River watershed area is now considered to be 4,674 square miles, from which 211 square miles are deducted for the diversions as above, leaving the net drainage area 4,463 square miles.

The average flow of the river during the year 1940 amounted to 1.703 cubic feet per second per square mile, which is 13.6 per cent more than the normal. The flow was in excess of the normal during the months of April, May, June, July, September, November and December. The greatest excess occurred in April and the largest deficiency in March.

Table Showing the Average Monthly Flow of the Merrimack River at Lawrence for the Year 1940; also the Normal and Departure therefrom in Cubic Feet per Second per Square Mile of Drainage Area.

Month	Normal Flow 1880-1940	Actual Flow in 1940	Excess or Deficiency
January	1.328	.481	— .847
February	1.365	.486	— .879
March	2.777	1.143	—1.634
April	3.698	6.314	+2.616
May	2.281	4.182	+1.901
June	1.281	2.430	+1.149
July	.775	.940	+ .165
August	.651	.520	— .131
September	.702	.709	+ .007
October	.804	.407	— .397
November	1.163	1.488	+ .325
December	1.167	1.335	+ .168
Average for whole year	1.499	1.703	+ .204

The following table gives the record of the flow of the Merrimack River at Lawrence for each of the past 6 years, together with the average flow in the past 61 years, this amount being expressed in cubic feet per second per square mile of drainage area.

Flow of the Merrimack River at Lawrence in Cubic Feet per Second per Square Mile

Month	1935	1936	1937	1938	1939	1940	Mean for sixty-one years, 1880-1940
January	3.039	1.687	2.620	2.117	1.760	.481	1.328
February	1.994	1.413	2.475	2.416	1.527	.486	1.365
March	3.020	10.408	2.067	2.467	2.403	1.143	2.777
April	3.313	4.477	3.679	2.884	5.691	6.314	3.698
May	2.025	1.867	4.289	1.862	2.735	4.182	2.281
June	2.292	.705	2.104	1.310	1.016	2.430	1.281
July	1.204	.478	.969	2.039	.489	.940	.775
August	.515	.359	.575	1.898	.508	.520	.651
September	.613	.411	.521	4.156	.367	.709	.702
October	.425	.889	.827	1.894	.399	.407	.804
November	.859	.969	2.083	1.640	.849	1.488	1.163
December	1.141	2.306	2.679	3.309	.688	1.335	1.167
Average for whole year	1.703	2.164	2.074	2.333	1.536	1.703	1.499
Average for driest six months	.793	.635	1.180	2.077	.550	.900	.877

Weekly Flow of the Sudbury, Nashua and Merrimack Rivers

The following table shows the weekly fluctuations during the year 1940 in the yield of the Sudbury River at Framingham, the South Branch of the Nashua River at the outlet of the Wachusett Reservoir in Clinton and the Merrimack River at Lawrence. The flow of these streams, particularly that of the Sudbury River and the South Branch of the Nashua River, serves to indicate the flow of other streams in eastern Massachusetts. The area of the Sudbury River watershed is 75.2 square miles, of the South Branch of the Nashua River 107.69 square miles, and of the Merrimack River at Lawrence 4,463 square miles.

Table Showing the Average Weekly Flow of the Sudbury, South Branch of the Nashua and the Merrimack Rivers for the Year 1940, in Cubic Feet per Second per Square Mile of Drainage Area

Week ending Sunday —	Yield of Sudbury River	Yield of South Branch Nashua River	Flow of Merrimack River	Week ending Sunday —	Yield of Sudbury River	Yield of South Branch Nashua River	Flow of Merrimack River
Jan. 7	.234	.495	.397	July 7	.990	1.121	1.079
14	.333	1.166	.346	14	.604	.941	1.045
21	2.533	2.256	.723	21	.455	.548	0.825
28	.451	.767	.463	28	.904	.908	0.861
Feb. 4	.158	.579	.365	Aug. 4	—.008	.340	.806
11	.690	1.323	.379	11	—.961	.512	.596
18	.624	1.578	.624	18	.059	.231	.416
25	1.690	1.254	.505	25	—.191	.258	.415
Mar. 3	.435	.766	.540	Sept. 1	—.149	.453	.438
10	1.752	1.092	.825	8	.037	.413	1.019
17	2.635	1.811	1.073	15	.133	.420	.681
24	4.514	2.516	1.490	22	—.178	.346	.562
31	4.445	5.013	1.475	29	.022	.533	.647
Apr. 7	8.375	10.441	4.789	Oct. 6	—.210	.319	.548
14	6.827	11.065	7.528	13	—.202	.350	.463
21	5.263	6.727	7.117	20	—.301	.292	.359
28	5.740	5.988	6.179	27	—.240	.153	.314
May 5	3.909	4.737	6.585	Nov. 3	.695	.982	.414
12	2.427	2.890	6.088	10	.741	.461	1.347
19	1.516	2.016	2.828	17	2.732	2.474	2.019
26	1.820	2.279	2.509	24	1.430	.833	1.810
June 2	3.555	4.182	3.477	Dec. 1	.856	1.086	1.124
9	1.855	1.928	3.996	8	.826	.887	1.024
16	1.059	1.427	2.184	15	1.495	1.388	1.120
23	.434	.702	1.635	22	1.760	1.931	1.483
30	.808	1.150	1.082	29	1.430	1.797	1.369

Examination of Rivers

The flow of streams in general throughout the State during 1940 was quite normal, though in the months of August, September and October, the flow in many of the streams was low but a serious low stage was not reached. Due in part to the low flow in the latter part of the summer and in part to sources of bacterial pollution, bathing was discontinued at certain points on the Charles River and it again became necessary to treat the water of certain bathing places in the Charles River Basin with chlorine to make the water suitable for bathing.

The following detailed reports relative to stream pollution have been published by the Work Projects Administration or its predecessor in the years indicated:

Blackstone River	September, 1936
Housatonic River	September, 1936
Nashua River	October, 1936
Hoosick River	October, 1936
French River	September, 1937
Deerfield River	November, 1937
Ten Mile River	January, 1938
Merrimack River	June, 1938
Connecticut River	January, 1940
Quinebaug River	March, 1940
Millers River	May, 1940
Taunton River	June, 1940
Westfield River	July, 1940
Chicopee River	August, 1940

Complaints were received during the past year relative to the pollution of the Westfield River, the Rumford River, the Charles River, the Mystic River, the French River and certain other smaller streams. Many of these streams have shown a very considerable concentration of pollution because of low water conditions. It became necessary during the year to order the release of additional quantities of water from Lake Miramichi into the Wading River, in part because of the lack of process water at a large industry and to improve the condition of the river due to dry weather.

Aberjona River

During the past year the improvement due to the use of the new North Metropolitan relief sewer in Winchester, Woburn and Stoneham has been maintained throughout practically the whole year. However, the Aberjona River Valley sewer of the city of Woburn has overflowed from time to time during the year and under date of May 4, 1940, it became necessary for the Department to again call the attention of the Woburn authorities to this violation of the law. Until this sewer is kept clean, more adequate preliminary treatment works provided for the industrial wastes, and until a more adequate sewer is constructed in this valley to serve the large industries in North Woburn, overflows are likely to occur from time to time and the Department will have no alternative but to proceed against the city under the provisions of Chapter 291 of the Acts of 1911. The necessary funds for the construction of an adequate sewer in this valley, which could be used in part for the removal of the sewage from a portion of the town of Reading, should be provided.

The analyses show an improvement in the river in the upper portion of its course and, with the exception of the portion of its course near Salem Street, Woburn, the river was in better condition than in recent years.

Assabet River

Analyses of the water of the Assabet River below Westborough still showed at times a rather low amount of dissolved oxygen, due apparently to the effect of the discharge of sewage effluent from the filter beds of the town of Westborough. The condition of the river improves in passing to Northborough. At a point above Hudson the river was in a satisfactory condition, and in passing Hudson the additional pollution was less noticeable than in the year 1939. The condition of the river at a point above Maynard was reasonably satisfactory but below Maynard, the analyses show a decided increase in pollution received as the river passes through this town, though it was somewhat better than in 1938. According to the analyses the condition of the river at the mouth was not objectionable.

During the past year it became necessary to refer to Chapter 655 of the Acts of 1914 relative to the pollution of the Assabet River in connection with certain sewer overflows into the river from various buildings, including a school in Maynard. Consideration was being given at the end of the year to relieving these sources of pollution by the extension of the Maynard sewerage system.

Blackstone River

The samples at the outlet of the Millbury Street Canal have shown objectionable pollution, but the main stream below the city of Worcester at a point above the entrance of the sewage effluent has shown no material change from the condition found in 1939. Below the entrance of the sewage effluent a slight increase in pollution has been noted and this is true at a point below Millbury and at Uxbridge, while lower down no material change was noted during the year. A complaint was made during the latter part of the year relative to the pollution of one of the tributaries in Millbury by industrial wastes and another complaint was made relative to the lack of a sewerage system in Uxbridge. The Blackstone River can be classed as an industrial stream. It is one of the most seriously polluted streams in the State. This pollution is due in large part to the discharge of industrial wastes, but domestic sewage from Millbury, Uxbridge and some of the smaller towns in the valley adds to the objectionable conditions. Presumably these objectionable conditions will continue until legislation adding to the authority of this or some other State Department has been put into effect.

Charles River

There has again been considerable controversy over the pollution of the Charles River, particularly because of the use of this river for bathing at various points along the lower part of its course. The analyses show that below Milford the stream has been in slightly better condition than in the previous year. Mine Brook showed less evidence of pollution than last year. The river showed somewhat more evidence of pollution in Medway, below Medfield, and at Needham and in its course in the vicinity of the Brookline and Newton pumping stations than in 1939. An increase in pollution was noted above Newton Lower Falls, and at Waltham an increase was noted as evidenced by a biochemical oxygen demand test of 6 parts per million. At the entrance to the Charles River Basin, a further slight increase in pollution was noted and the results of the analyses of samples of water collected from the upper portion of the basin also showed an increase in pollution, though there was no material change of conditions in the lower part of the basin. Large numbers of bacteria were again found in the river below a bleachery at Waltham and, as indicated elsewhere in this report, it was necessary to discontinue bathing at at least one beach along the basin and to chlorinate the water to make it suitable for bathing at certain of the Charles River Basin beaches.

More drastic legislation relative to the powers of the Department in preventing pollution of this stream should be enacted by the Legislature of 1941.

Chicopee River

The results of the analyses show an increase in pollution of the Quaboag River below Palmer, an increase in pollution below Barre, and somewhat more evidence of pollution below Ware to the mouth of the Ware River. Analyses of the water of the main stream itself have as yet not shown the improvement to be expected from the new partial treatment works in the Indian Orchard portion of the city of Springfield. Further improvement is to be expected from the operation of the new works at Ludlow which are nearing completion. The river at the mouth showed a slight improvement over the previous year. The intercepting sewer at Ware was practically completed during the latter part of the year and the outfall sewer into the river constructed. These works should improve the character of the water of the Ware River as it passes through the thickly-settled portions of the town and prevent local nuisances. New sewage treatment works have been installed at the Monson State Hospital and were placed in operation on November 7, 1940.

Concord and Sudbury Rivers

Analyses of samples of the water of Bannister Brook, collected just below the point at which the effluent from the Natick and Framingham sewage disposal works is discharged, show a marked increase in pollution during the past year due apparently to certain difficulties in the operation of these two sewage treatment works. This matter is referred to in another portion of the report. An improvement in the character of effluent discharged from these two works is expected early during the coming year. Bannister Brook at the mouth has shown less evidence of pollution than in 1939. This is also true of the Sudbury River below the entrance of Bannister Brook. The Sudbury River at its mouth contained dissolved oxygen to the extent of 80 per cent saturation. Organic pollution resulted in a higher biochemical oxygen demand than in recent years. No complaint has been made over the condition of the Sudbury River or its tributaries. Various conferences have been held during the year relative to the removal of the pollution of Beaver Brook in the town of Chelmsford but the situation had not been corrected at the end of the year.

The Concord River at North Billerica showed less evidence of pollution than in recent years. At a point near its mouth the river receives a considerable amount of sewage.

Connecticut River

The analyses of the water of the Connecticut River showed more evidence of pollution during the past year where the river enters the State than at the point where it leaves the State and enters Connecticut. The improvement at the Connecticut line is believed to be due to the completion of the four sewage treatment works which were put into operation early during the summer of 1940, viz., the main works of the city of Springfield, the Indian Orchard works of the city of Springfield and the new works at Amherst and Greenfield. Much progress has been made in the construction of sewage treatment works in Ludlow and East Longmeadow. The samples obtained from the Mill River in Northampton below the sewer outlets show that this river contained a large percentage of sewage giving a biochemical oxygen demand determination of 123 parts per million, or nearly as much as the North River in Peabody and Salem, which is the most polluted stream in the State. Both the Mill River and the North River constitute severe odor nuisances. Several conferences were held with the Northampton authorities during the year and several plans for sewerage were submitted to the Department for approval. A local sewerage committee was established to cooperate with the constituted sewer commissioners of Northampton and engineers were engaged for the study of the sewerage needs. Plans were given provisional approval by the Department for the construction of a trunk sewer with outlet works to the Connecticut River to relieve the objectionable condition of the Mill River, and provisional approval was given to a location plan for works for partial treatment of the sewage at a site inside the dike, the effluent from these works to be discharged to the outfall sewer leading to the Connecticut River. Some legal difficulties have been encountered in the construction of the outfall sewer and, while certain contracts have been let, no construction had been started at the end of the year. The correction of the Northampton sewage disposal nuisance is one of the most important sanitary problems in the State and it is expected that it will be partially adjusted at least during the coming year.

The analyses of the water of the Manhan River have shown an increase in pollution over the past few years, due largely to the overflow of untreated sewage from the town of Easthampton.

Special studies have been made during the year relative to the conditions of the river within the limits of the city of Springfield to assist in regulating the overflow of sewage from the combined sewers and to determine the effect of the effluent from the new main sewage treatment works of the city of Springfield.

The city of Chicopee and the towns of West Springfield and Longmeadow are making engineering studies relative to the treatment of sewage entering this stream from these municipalities and it is expected that additional progress will be made during the coming year, also in the construction of treatment works in South Hadley. When these improvements have been completed the only important sources of sewage pollution of the main body of the Connecticut River in Massachusetts will be the sewage of the city of Holyoke and the town of Montague.

French River

Complaint was again made during the year relative to the objectionable condition of the French River below Webster and Dudley. The results of the analyses of samples of water taken from the river below these towns do not show any additional pollution over those of 1939 but they do show, nevertheless, more pollution than in most of the earlier years since examinations have been made of this stream. During the past year this stream has been particularly objectionable during week-ends and nights when no considerable quantity of water was drawn from storage for power purposes. So far as the information available to this Department is concerned, the two responsible municipalities, Webster and Dudley, have taken no action in preventing the pollution of the French River during the year and under present conditions of sewage disposal it is to be expected that this stream must continue to be the cause of complaint. It is unfortunate that these municipalities do not realize the objection that this stream is causing, not only to the persons residing on its banks in Massachusetts, but also within the State of Connecticut, where, regardless of greater dilution, the municipalities have already constructed treatment works.

Hoosick River

The Hoosick River continues to be extremely objectionable below Adams and Williamstown from the discharge of domestic sewage. The discharge of industrial wastes from North Adams and Adams adds to the pollution. The biochemical oxygen demand of the South Branch of the Hoosick River below Adams was 17.5 parts per million and 8 parts per million at its junction with the North Branch in North Adams. The sewage treatment works of the city of North Adams are operated in a satisfactory manner but the improvement effectuated by these works is voided to some extent because of the domestic sewage from Adams and industrial wastes discharged into the stream.

During the past year a W.P.A. project for the construction of sanitary sewers in certain streets in Adams was approved by the Department with the understanding that they are to be a part of the general plan for the collection, treatment and disposal of sewage of the town of Adams. It is understood that the town has appointed a committee to investigate matters of sewage disposal and has appropriated certain funds for the committee's expenses. The committee has not submitted any report or plans to the Department for its consideration. Until the sewage of the town of Adams is collected and treated, the South Branch of this stream will continue to be in an objectionable condition below the town and throughout that portion lying within the city of North Adams.

Housatonic River

The analyses have shown an increase in pollution below Dalton, and the East Branch at the mouth also has shown an increase in pollution over the last few years. Below the city of Pittsfield no noticeable change in the condition of the river has occurred so far as the analyses are concerned and the river was in somewhat better condition below the Pittsfield sewage treatment plant than last year. The analyses show a marked increase in pollution below Lee where the biochemical oxygen demand increased from 6.9 in 1939 to 17.6 in 1940. An increase in pollution also was noted below Stockbridge but, due to dilution or other causes, the condition was better below Great Barrington at a point near the Connecticut line than in recent years. The objectionable condition immediately below Lee is due not only to the discharge of raw sewage into the river from that town but also to an increased amount of industrial wastes from the manufacture of paper in Lee. Examinations have shown that the river below Lee is often covered with an offensive brown foam which has been reported at a point even below Stockbridge. Experiments by the Department have as yet indicated no practicable method of treatment of the wastes causing this condition. The town of Lee has given some consideration to the construction of sewers and treatment works but no definite action has as yet been taken. Complaints have been made to representatives of the Department in the Glendale section of Stockbridge of the presence of dead fish. The city of Pittsfield and the towns of Stockbridge and Lenox have taken action to prevent the direct discharge of sewage into this stream. This valley is used very extensively for recreational purposes and it is unfortunate that the towns of Hinsdale, Dalton, Lee and Great Barrington do not construct sewage treatment works.

Merrimack River

Regular examinations have been made of this stream during the months June to November. The river below Lowell has shown an increase in pollution over recent years and this has been noted downstream to a point just above Lawrence. The main stream below Lawrence has shown an increase in biochemical oxygen demand over last year and there is an indication of an increase in pollution of the main stream above Haverhill, while below Haverhill and at the mouth no particular change was noted during the year. The Shawsheen River has shown a slight increase in the amount of putrescible organic matter and complaint was made during the year relative to the discharge of sewage and wastes into the Shawsheen River from the Shawsheen Village portion of Andover. The Department, acting under the provisions of Chapter 505 of the Acts of 1909 and Chapter 202 of the Acts of 1929, has made regular examinations. There have been no particular activities during the past year looking to the construction of works for preventing or reducing pollution of this stream, nor has the Special Commission established under Chapter 446 of the Acts of 1935 as amended filed legislation in this regard. Several extensions have been made to the sewerage systems of Andover, North Andover, Lawrence, Lowell and Haverhill under W.P.A. auspices during the year.

Millers River

The analyses of samples collected from the Millers River below the Templeton works of the city of Gardner have again shown more pollution than for many years and even to a point as far downstream as Athol the analyses indicate a gradual increase in pollution. The sewage of Athol and Orange adds to this pollution, but below Orange the condition of the stream, judging from the analyses, was not objectionable. The city authorities of Gardner have discussed the matter of improving the sewage treatment works of this city and are obtaining consulting engineering advice but no funds have as yet been appropriated for the necessary improvements.

Mystic River

The analyses show that the water flowing from the lower Mystic Lake was in a reasonably satisfactory condition during the year. Alewife Brook at its mouth has shown considerable pollution at times and the Department has found it necessary, during the year, to call the attention of the authorities of the city of Cambridge and certain industrial works in Somerville to the provisions of the General Acts of 1918, Chapter 88, and to recommend against bathing in the Mystic River just below the mouth of Alewife Brook. Alewife Brook at its mouth has been in an objectionable condition due, in large part, to the overflow of combined domestic sewage and storm water from the combined sewers of the cities of Cambridge and Somerville. At times there have been overflows from sanitary sewers in Somerville to surface water drains entering the Mystic River. These overflows have been corrected, temporarily, at least. While action has been taken to stop some of this overflow there will continue to be an overflow from the combined sewers of Cambridge and Somerville until a suitable intercepting sewer has been constructed along this stream to remove all of the sewage and a fair proportion of the mixed domestic sewage and storm water. The new North Metropolitan relief sewer has been effective in preventing much of the pollution formerly reaching this stream.

Nashua River

The North Branch of the Nashua River above the entrance of the sewage effluent from the Fitchburg sewage treatment works has shown very objectionable conditions during the past year due in part to the industrial wastes discharged into the stream and in part to the overflow of sewage from a low level district in the city of Fitchburg, the sewage of which has not been pumped during the year into the main sewerage system. Plans have been considered during the past year for the construction of a suitable pumping station under Federal funds but this station had not been constructed at the end of the year. Below the sewage treatment plant the stream still showed evidence of pollution, particularly by industrial waste, but it was not materially different from the condition found in 1939. There is still evidence of pollution of Monoosnock Brook at the mouth but, so far as the records of the Department are concerned, no material quantity of sewage is discharged into this stream from the sewerage system of the city of Leominster. The river below the treatment works of the city of Leominster showed an improvement as compared to 1939, though at the mouth of this stream the analyses showed more evidence of pollution than in recent years. From such information as is available this is due very largely to the discharge of industrial wastes into the stream, particularly from the city of Fitchburg.

The analyses of the South Branch of the Nashua River below the effluent from the Clinton sewage filters showed more evidence of pollution than in any year since the samples were started. The main stream at Groton also showed somewhat more evidence of pollution than in recent years and at its mouth in Nashua, New Hampshire, evidence of pollution also was indicated. The Department has spent considerable time during the past summer in studying the question of sewage disposal at Clinton particularly with relation to the taking over of the works by the town.

Neponset River

The analyses show a slight increase in the biochemical oxygen demand of this stream in the central part of Walpole, but at a point below East Walpole the river appeared to be in a somewhat better condition than in 1939. The Canton River at its mouth showed a slight increase in pollution but below the Canton River no material change in the condition of the river was noted though in the lower portion of the river, in Milton and the Mattapan section of Boston, the river was in a slightly better condition than last year. It became necessary to recommend the extension of the sewerage system in Canton during the year for the removal of some of the industrial wastes discharging into this stream in regard to which a complaint had been made. Complaint was made relative to the growth of microscopic organisms in the upper portion of the stream during the latter part of the year.

North River, Peabody and Salem

The North River and its tributaries in Peabody and Salem have shown more evidence of pollution than in recent years, and at its mouth in Salem the river was again devoid of oxygen at each time the samples were collected. This stream continues to be the most seriously polluted stream in the State and in general is similar to a strong domestic sewage. Some consideration was given toward the end of the year to prosecutions of certain industries in Peabody by the Salem authorities.

Quinebaug River

The Federal Works Projects Administration Pollution Report on the Quinebaug River was published during the past year. The usual samples of water were collected from above and below the Southbridge sewage filter beds. The analyses show a considerable increase in pollution above the filter beds, due probably to the overflow of sewage above the filter beds, while below the filter beds the river was not materially different from the condition found in 1939, which showed a greater concentration of pollution due to the sewage and wastes discharged into it from Southbridge than has usually been the case in recent years. The Department has found raw sewage overflowing from the main sewerage system of the town of Southbridge on occasions during the past year and, while plans have been prepared for the improvement of the sewerage system and for the construction of disposal works, no final action had been taken on these plans at the end of the year. It is expected, however, that the town will take favorable action on these plans early in the coming year.

Taunton River

The analyses of samples from the Salisbury Plain River below Brockton show more evidence of pollution than in any recent year. An increase in pollution also was noted in Cowesset Brook below the Brockton sewage treatment plant and there is more evidence of pollution in the Town River at a point above Bridgewater than in recent years. This also was true of the Town River below Bridgewater where sewage is discharged directly to the stream without treatment. The main Taunton River just below the junction of the Town and Matfield rivers shows an increase in pollution over 1939, but the main stream above Taunton was not materially different than in recent years and contained dissolved oxygen to the extent of 64 per cent saturation. The main stream below Taunton at Berkley Bridge showed a slight increase in the biochemical oxygen demand, while the dissolved oxygen determination at this point showed only 39.9 per cent saturation.

Conferences have again been held with the Taunton authorities relative to the collection of the sewage for ultimate treatment and various conferences have been held with the Fall River authorities. No suitable action has as yet been taken toward preventing the pollution of the stream by either of these cities. During the past year the Department approved a Work Projects Administration project for the improvement of the sand filters at Brockton in connection with which it was necessary to by-pass the settled trickling filter effluent around the sand filters during the drier portions of the year.

Ten Mile River

The Ten Mile River below Attleboro showed a marked increase in pollution during the year 1940. Some sewage has reached the river from the North Attleborough sewers without treatment and the Department has conferred with the authorities of North Attleborough during the year relative to the elimination of leakage from the sewerage system. A complaint was made because of the discharge of offensive wastes from an industrial plant in Attleboro and this matter was called to the attention of the Attleboro Health Department for action. The Department was investigating the discharge of certain industrial wastes into the Ten Mile River at the end of the year.

Westfield River

The regular routine analyses have shown no particular change in the Westfield River during the past year. However, during the past summer there was evidence again that some industrial waste discharged into this stream had a toxic effect upon fish life. These wastes possibly are discharged into the sewerage system of Westfield which has outlets into the river but due to the intermittent discharge it has been impracticable to determine the source. During the year the Division of Sanitary Engineering conferred with the Westfield authorities relative to the construction of sewage treatment works. The river below Russell is discolored by dyes which are noticeable for a considerable distance downstream. The death of fish has resulted in local nuisances along the river banks in West Springfield and it has been necessary for the Board of Health of that town to remove dead fish for disposal elsewhere.

Municipal Sewage Treatment Works

As required by the General Laws, the Division of Sanitary Engineering has examined the various municipal sewage treatment works in the State during the year and the main outlets of municipal sewers and has investigated the effect of sewage disposal. Examinations also have been made of the sewage treatment works of state, county and other institutions and at industrial plants. Samples have been collected of the sewage and effluent of the municipal sewage treatment works but, as indicated a year ago, a reduction has been made in this analytical work. The samples collected in connection with the large sewage disposal works were largely in composite parts. During the latter part of the summer and fall, due to low ground water conditions, the sewage has in many instances been somewhat stronger than in other periods. Following are statements of conditions at the various municipal sewage treatment works. These statements are followed by analytical and flow data in the usual tabular form.

Amherst

The Amherst sewage treatment works commenced operation on May 1. The works include devices for screening and comminuting the heavy suspended matters, grit chambers and sedimentation tanks. The effluent is pumped into the existing trunk sewer through which it is conveyed to the Connecticut River. The settled sludge is treated in separate sludge digestion tanks and dried on covered and uncovered sludge drying beds. During the earlier periods of operation, this plant was under the direction of the engineer who constructed the plant and a representative of the Department. A small amount of digested sludge from another treatment plant was used to seed the sludge in one of the digestion tanks. Some difficulty has been experienced in the removal of the sludge from the settling tanks and it may be necessary to partially remove the concrete slabs directly over the sludge hoppers in order that the sludge may be moved by hand. The results of the analyses show that the works operated efficiently during the year. The local operator is becoming equipped to carry on certain analytical work.

Attleboro

The raw sewage reaching this plant during 1940 was somewhat stronger than in 1939. The effluent, while high in nitrates, contained more organic matter than usual. The cost of properly maintaining these filters can be reduced if the solid matters in the sewage are removed by sedimentation tanks as has been recommended by the Department. The use of such tanks would doubtless improve the degree of purification.

Barnstable

The works for the treatment of the sewage of Hyannis have operated satisfactorily during the year under expert attention.

Billerica

It is expected that the privately-owned works at North Billerica will be taken over by the town early in 1941 in accordance with the Department's communication dated May 14, 1940. It is hoped that under town supervision these works will be maintained in better condition than has been the case in recent years.

Brockton

In connection with the reconstruction of some of the sand filters under a Work Projects Administration project, it was necessary to discharge more than the ususal quantities of settled trickling effluent direct to the river without refiltration through the sand filters. The basic works consisting of settling tanks, trickling filters and secondary settling tanks, which have been operated under expert care, have produced a reasonably satisfactory effluent, but due to lack of adequate dilution in the Cowessett River during certain portions of the year, better conditions would have been effected had the sand beds been used for the refiltration of the secondary tank effluent.

Clinton

This plant has been operated in the usual manner during the past year with the sewage being distributed over the various filters in such a manner as not to overcrowd them. The surplus sewage, amounting at times to over a quarter of the amount pumped, overflows to the sludge beds and thence to the effluent brook. The sewage has been somewhat heavier than last year and by the present method of operation the effluent was accordingly considerably better than last year. Sewage was allowed to overflow into the river from the pumping station on some 21 days during the year.

In response to an application for advice from the Metropolitan District Commission the Department has investigated the matter of the disposal of sewage from the town of Clinton and has considered the normal capacity of the South Branch of the Nashua River to care for the sewage of that town within the meaning of Section 3 of Chapter 557 of the Acts of 1898. The investigation made in connection with this application led the Department at the meeting of the Public Health Council on September 10, 1940, to express the opinion that the town had outgrown the normal capacity of the river and, in connection with the action above referred to, the Department recommended that the Metropolitan District Commission construct in the vicinity of the present pumping station modern works to provide for the proper disposal of all of the sewage of this town. These works will be necessary in any case when the town assumes its responsibility for the proper disposal of its sewage. Conferences have been held with the Metropolitan District Commission and the authorities of the town of Clinton and it is expected that further conferences will be held early in the coming year.

Concord

The observations show a marked increase in the strength of the sewage treated at these works during the past year and a smaller degree of efficiency than at any time since these works were placed in operation. The sewage is not evenly distributed over the filter beds as is necessary to secure a suitable effluent. This plant should receive adequate attention if a satisfactory effluent is to be produced.

Easthampton

This plant was operated in the usual manner, the greater portion of sewage being conveyed to the sewage treatment works, but only about 20 per cent of the settled sewage is treated on the sand filters. These filters are entirely inadequate to take care of the sewage of the town and are generally flooded with sewage. Thus, excessive quantities of sewage overflow into the Manhan River from these works. It will be necessary in the near future for the Department to take action against the town under Chapter 83 of the General Laws.

Fitchburg

The sewage treatment plant of the city of Fitchburg has been in operation throughout the year with somewhat heavier sewage than usual, but the effluent has been fully as good as in recent years. The sewage from a low area in Fitchburg continued to be discharged into the Nashua River throughout the year because of the fact that the present pumping station is poorly located and is of inadequate capacity. Conferences were held early in the year relative to plans for a new station to be constructed under a Federal project but the works have not as yet been constructed.

Foxborough

Much of the sewage collected in the Foxborough sewerage system has been treated by the sand filters or the subsurface system, but examinations during the year showed evidence that sewage had overflowed at times of storm into the ponded area below the filter plant. At the time of one examination during dry weather the weir over which the overflow takes place was not operating properly and some of the sewage was escaping without treatment. The brook through which the effluent is conveyed to the ponded area below the filters has contained sewage matters at several examinations.

Framingham

The efficiency of the new works has not been satisfactory but the effluent, however, was of better quality than in 1939. A rate controller has been installed near the dosing tank which provides somewhat better control of the operation of the new trickling filter. For a short period near the end of the year difficulty was experienced with the dosing tank at the trickling filter plant and it became necessary to by-pass sewage to the effluent channel for a short period. Some difficulty has been experienced in the operation of the secondary settling tank, due possibly to the withdrawing of sludge at too infrequent periods. These works are operated under the attention of a trained operator.

Consideration was being given at the end of the year to the installation of a comminutor and possibly a grit chamber at the main pumping station at South Framingham.

Franklin

This plant was operated satisfactorily during the year. The Timnah Brook plant has received very little attention.

Gardner

The sewage of the city of Gardner is not properly treated and, as indicated elsewhere, the Millers River is polluted by the overflow of raw sewage and inadequately purified sewage. The Department is informed that toward the end of the year a consulting engineer had been employed to investigate the sewerage system and sewage disposal works. No plans or report of the engineer have as yet been forwarded to the Department as required by law. The capacity of both of the sewage disposal plants at Gardner has been outgrown and modern sewage disposal works should be constructed.

Greenfield

A new sewage treatment plant at Greenfield was started in operation during the latter part of June, 1940. The treatment works consist of a grit chamber, screening with comminution of the screenings and sedimentation in covered, rectangular settling tanks, the sludge from which is pumped into sludge digestion tanks, one of which is heated. The sludge is dried on open sludge beds. This plant was operated in the beginning under the direction of the designing engineer and lime was used in the beginning to maintain a satisfactory pH in the digester. Some sludge was obtained from another plant for seeding purposes.

Frequent examinations by engineers from the Department have shown no evidence of odors in the vicinity, though it is possible that during the breaking-in period limited quantities of sludge gas were released in connection with the adjustment of certain mechanical devices.

Hopedale

The works at Hopedale have continued to provide satisfactory results during the year.

Hudson

The Hudson sewage is one of the strongest of any of the municipal sewages treated in the State. The effluent has been of very poor quality during the past year. A Federal Work Projects Administration project for the reconstruction of the filter beds by removing some of the surface material and replacing it with clean sand and the possible construction of additional filter beds has been considered but this project has not yet been carried out. The Department in its efforts to prevent the pollution of the Assabet River will be faced with no other alternative but to take action against the town of Hudson unless improvements are shortly effected.

Leicester

The filter beds do not receive sufficient attention and are at times heavily overloaded, which facts are reflected in a deterioration in quality of the effluent from the plant. Further extension of this plant must be made in the near future or the Department of Public Health must proceed against the town of Leicester under the provisions of Chapter 83 of the General Laws.

Lenox

This plant has been operated satisfactorily during the year. A greater effort has been made to rotate the use of the sand filters regularly, thus preventing the overdosing of any single filter unit.

Leominster

The activated sludge plant of the city of Leominster has been operated satisfactorily throughout the year and has shown an improvement in the final effluent over that of the first two years of operation.

Mansfield

The new sewage treatment works in Mansfield were placed in operation in June, 1940. The works consist of comminutors, Imhoff tanks, trickling filters and secondary sedimentation tanks. Thus far, the plant is operating far below its normal capacity as connections from buildings housing only some 500 persons have been made. The sewage appears to be a reasonably normal sewage and the plant has shown a good degree of efficiency.

Marion

The sewage collected in the Marion sewerage system during the periods of high ground water was very weak due to excessive amounts of leakage into parts of the system. Limited quantities of sewage have overflowed from the Silver Shell Pumping Station and from the main sewerage system, but during the latter part of the year these overflows were sealed. The effluent from the filter beds has been satisfactory according to the results of the Department's analyses. It is important, nevertheless, that attention be given to reducing leakage into the sewerage system and to the possible construction of a new force main to cut down the friction due to pumping excess quantities of sewage. It is also advisable that a suitable means of measuring the sewage be provided. Consideration was being given at the end of the year to carrying out these improvements and the local officials were consulting with an engineer at the end of the year. As soon as the quantity of sewage can be definitely determined the question of the necessity of enlarging the filter beds can be considered.

Marlborough

The final results have been somewhat less satisfactory than in recent years and further reconstruction and modernization of these works will be necessary in the near future. It is important that this plant be operated with great care in view of the fact that the effluent is discharged into a very small stream.

Maynard

The average biochemical oxygen demand showed an over-all reduction of 90 per cent. The end nozzles in the trickling filter distribution system, referred to a year ago, have been replaced. The Maynard sewage is one of the strongest sewages in this State and close supervision must be given to the operation of this plant in order that it may be operated in an efficient manner.

Medfield

Very little effluent appears in the underdrains at this plant, indicating that much of the sewage is absorbed in the sub-soil. This plant is given very little attention.

Milford

This plant, consisting of two separate units of Imhoff tanks and trickling filters, has operated with more satisfactory results during the past year than in recent years. Early in the year, *viz.*, March 7, 1940, the Department recommended that a suitable operator be selected for the operation of these works and for a time the works were operated under the direction of the engineer who constructed them. The improved results appear to have been maintained with reasonable satisfaction throughout the remainder of the year. It is important that the works be operated under suitable attention at all times in view of the use of the Charles River for recreation.

Millis

The sewage of the town of Millis is very weak. The effluent shows a high degree of purification.

Nantucket

The analyses indicate a weaker sewage during the past year. Somewhat more attention has been given to the operation of the filter beds, but experience shows that constant attention is required to prevent the interference created by the winds blowing the finer sand onto the filters. During the winter months considerable quantities of the sewage are not treated on the beds but, as this plant is well isolated in a sandy area, no particularly objectionable conditions were created and no complaint has been made to the Department during the year. Consideration has been given to Work Projects Administration proposals for the construction of sewers during the year.

Natick

During the latter part of the year a request was made for advice relative to relieving objectionable conditions in connection with the Imhoff tanks and the matter was being investigated at the end of the year. It appeared that a thick blanket of fermenting sludge had accumulated on the surface of the sewage in the easterly tank. The sludge in the Imhoff tanks was drawn down and all floating sludge pushed through the slot. Experiments did not indicate the need of adding lime but it was necessary to break up the scum in the gas vents. Considerable inorganic matter has been found in the sludge which may indicate the desirability of installing grit chambers at the pumping station. The analyses of the sewage, settled sewage and effluent have shown an increase in the strength of the sewage, and an increase in the suspended solids, organic matter and biochemical oxygen demand in the final effluent over 1939 was also noted. It is advisable that this plant be operated under the supervision of an engineer or chemist experienced in sewage disposal matters for a time at least during the coming year.

North Adams

This plant has effected a removal of about 45 per cent of the biochemical oxygen demand in the raw sewage during the past year. The sewage was prechlorinated from June 5 to October 20 with a dosage of about 6.4 parts per million. The sludge digestion has been good and only 1.7 gallons of oil per million gallons of sewage have been required for properly heating the sludge. No objectionable odors have been noticed in the vicinity of the plant. Some difficulty has been experienced in the siphon on the main sewer leading to the works.

North Attleborough

The effluent from the sand filters at North Attleborough has been slightly better than the last two or three years but nevertheless some sewage has been allowed to overflow without treatment. One filter bed was reconstructed during the year and plans have been made for reconstructing another during the coming year. It is also proposed to repair the settling and dosing tanks. The high flows of sewage are not recorded and an accurate measuring device for all flows should be installed. Several conferences were held with the local authorities during the year relative to leakage into the sewers.

Northbridge

These works have been operated with reasonably satisfactory results during the year but it has been necessary to operate the works at a high rate and an extension of the sewage treatment plant is required.

Pittsfield

About 70 per cent of the sewage pumped to the sewage disposal works at Pittsfield was treated on the trickling filters during the past year while the remainder was discharged upon the sand filters. This required the operation of the trickling filters at a rate of 2.75 million gallons per acre per day. The efficiency of the sand filters has shown an improvement over the previous year. The trickling filter portion of the works showed over-all reductions of 75 per cent of suspended solids and about 93 per cent biochemical oxygen demand. Raw sewage was discharged into the Housatonic River from the pumping station for 11 days without treatment and a considerable part of the sewage was allowed to overflow 33 days after primary treatment by sedimentation only. New underdrains were laid in some of the sand filters under a Federal appropriation during the year.

Southbridge

The results of the analyses of samples of raw and settled sewage show very little difference in the effectiveness of the preliminary treatment of the sewage in its passage through the settling tanks from earlier years. The removal in the suspended solids by sedimentation was only 42 per cent while the B.O.D. removal was 12 per cent. The final effluent of the sand filters showed a smaller degree of purification than in any recent year and the brook below the filter beds showed more evidence of pollution than in recent years. The sand filters are heavily loaded and on certain occasions during the past year sewage has been found overflowing from the main sewerage system of the town of Southbridge. The Department stated in its Annual Report of 1939 that, unless adequate sewage treatment works are provided and the overflow of sewage prevented, the Department should proceed against the town under the provisions of Chapter 83 of the General Laws. The town has appointed a Special Sewage Disposal Committee and has engaged engineers on the question of sewerage and sewage disposal. The report and plans of the engineers were considered by the Department and a communication was sent to the Special Sewage Disposal Committee under date of August 5, 1940. The plans provided for certain improvements in the sewerage system and for the construction of screens, mechanically cleaned preliminary sedimentation tanks, two circular high rate trickling filters, final sedimentation tanks, a sludge digestion tank and open sludge drying beds. It was proposed to recirculate some of the settled effluent through the trickling filters which would be operated at minimum rates of 10 to 15 million gallons per acre per day. During the drier 6 to 8 months of the year it was proposed to refilter the settled trickling filter effluent through some of the sand filter beds. The engineers also proposed a method of mechanical treatment of the so-called rouge wastes from the optical works. After consideration of the plans the Department, in the communication above referred to, provisionally approved the proposed project with the understanding that before construction is started detailed plans of the proposed works will be submitted to the Department for final approval. The Department also offered certain suggestions relative to the treatment of the rouge wastes with alum and soda ash.

It is understood that the matter of financing the construction of the proposed sewerage improvements has been postponed by the town but that favorable consideration may be given to this work early in the coming year so that action by the Department, as referred to in its Annual Report of 1939, will not be necessary.

Spencer

The old filtration area should be remodeled and consideration given to the construction of dikes in order to divide the large filters into smaller units which will be easier to operate and to maintain. In connection with this reconstruction the town should give consideration to providing more adequate treatment works in order that the overflow of sewage may be prevented.

Springfield

The new main sewage disposal works of the city of Springfield was placed in operation on July 1. This plant provides for removing grit, screening and comminuting the screenings, sedimentation with separate sludge digestion, elutriation and vacuum filtration of the digested sludge and incineration of the dewatered sludge. The quantity of sewage has averaged about 20 million gallons per day with an all-over reduction of biochemical oxygen demand of only 18 per cent and suspended solids of about 52 per cent. This plant is being operated under expert care with laboratory control.

The new Indian Orchard plant was placed in operation on June 24 and provides for screening through manually cleaned bar racks, trituration of the screenings and sedimentation of the sewage. The sludge is pumped to two digesters and after digestion is dried on covered sludge drying beds. Complete operating data are not at present available.

Stockbridge

This plant has been operated in a satisfactory manner largely through the efforts of the operator. The underdrains in the irrigation filter beds were relaid during the past year under a Federal project. It is important that suitable means of measureing the sewage be provided at this plant.

Westborough

The works at Westborough have been operated in the usual manner. Conferences were held during the year with the Westborough authorities and suggestions made relative to the more even distribution of the sewage and the possibility of dividing the larger beds into smaller units. These suggestions have not as yet been carried out. During the year a discharge of tannery waste temporarily interfered with the operation of the filters but the condition was of a temporary nature only. The final effluent from the Westborough filters was of less satisfactory quality than for several years.

Winchendon

The dosing tank counter installed in 1939 was out of order for about six months during the year. This plant continues to be well operated and to provide a satisfactory degree of purification.

Worcester

The analyses show an increase in strength of the sewage but according to the Department's analyses the final effluent has been reasonably satisfactory. This plant is operated under the efficient supervision of a chemist. The filters have been flooded frequently in order to control the fly nuisance. Only one complaint has been made relative to objectionable conditions in the vicinity of the works.

Analytical Results of Analyses and Records of Operation

The analytical results relative to the operation of the important sewage treatment works in the State are shown in the following tables:

Sewerage and Sewage Disposal in Massachusetts, 1940

City or Town	Population 1940	Means of Disposal	Sewage or Effluent Discharged into
Abington	5,708	None	– –
Acton	2,701	None	– –
Acushnet	4,145	None	– –
Adams	12,608	Dilution	Hoosick River
Agawam	7,842	Dilution	Westfield River
Alford	201	None	– –
Amesbury	10,862	Dilution	Merrimack River
Amherst	6,410	Sedimentation tanks, separate sludge digestion	Connecticut River
Andover	11,122	Dilution	Merrimack River
Arlington	40,013	North Metropolitan District	Boston Harbor
Ashburnham	2,255	None	– –
Ashby	1,026	None	– –
Ashfield	872	None	– –
Ashland	2,479	None	– –
Athol	11,180	Dilution	Millers River
ATTLEBORO	22,071	Sand filters	Ten Mile River
Auburn	6,629	None	– –
Avon	2,335	None	– –
Ayer	3,5[illegible]2	None	– –
Barnstable	8,333	Imhoff tanks, sand filters	None
Barre	3,528	None	– –
Becket	689	None	– –
Bedford	3,807	None	– –
Belchertown	3,503	None	– –
Bellingham	2,979	None	– –
Belmont	26,867	North Metropolitan District	Boston Harbor
Berkley	1,130	None	– –
Berlin	1,057	None	– –
Bernardston	954	None	– –
BEVERLY	25,537	South Essex Sewerage District	Salem Harbor
Billerica	7,933	Sand filters	Concord River
Blackstone	4,566	None	– –
Blandford	479	None	– –
Bolton	775	None	– –
BOSTON	770,816	Boston Main Drainage, North Metropolitan and South Metropolitan Districts	Boston Harbor
Bourne	3,315	None	– –
Boxborough	376	None	– –
Boxford	778	None	– –
Boylston	1,388	None	– –
Braintree	16,378	South Metropolitan District	Boston Harbor
Brewster	827	None	– –
Bridgewater	8,902	Dilution	Town River
Brimfield	1,012	None	– –
BROCKTON	62,343	Sedimentation, trickling filters, secondary sedimentation and sand filters	Cowesset River
Brookfield	1,393	None	– –
Brookline	49,786	South Metropolitan District	Boston Harbor
Buckland	1,527	None	– –
Burlington	2,275	None	– –
CAMBRIDGE	110,879	North Metropolitan District	Boston Harbor
Canton	6,381	South Metropolitan District	Boston Harbor
Carlisle	747	None	– –
Carver	1,469	None	– –
Charlemont	789	None	– –
Charlton	2,557	None	– –
Chatham	2,136	None	– –
Chelmsford	8,077	None	– –
CHELSEA	41,259	North Metropolitan District	Boston Harbor
Cheshire	1,708	None	– –
Chester	1,284	None	– –
Chesterfield	422	None	– –
CHICOPEE	41,664	Dilution	Chicopee and Connecticut Rivers
Chilmark	226	None	– –
Clarksburg	1,317	None	– –
Clinton	12,440	Sedimentation basins, sand filters	Nashua River
Cohasset	3,111	None	– –
Colrain	1,497	None	– –
Concord	7,972	Sand filters	Concord River
Conway	944	None	– –
Cummington	608	None	– –
Dalton	4,206	Dilution	Housatonic River
Danvers	14,179	(a) None	–
Dartmouth	9,011	None—small part connected to New Bedford Sewers	– –
Dedham	15,508	South Metropolitan District	Boston Harbor
Deerfield	2,684	Dilution	Deerfield River and Connecticut River
Dennis	2,015	None	– –

(a) Member of South Essex Sewerage District but has no service connections.

Sewerage and Sewage Disposal in Massachusetts, 1940—Continued

City or Town	Population 1940	Means of Disposal	Sewage or Effluent Discharged into
Dighton	2,983	None	– –
Douglas	2,617	None	– —
Dover	1,374	None	– –
Dracut	7,339	(b) None	– –
Dudley	4,616	Dilution	French River
Dunstable	447	None	– –
Duxbury	2,359	None	– –
East Bridgewater	3,832	None	– –
East Brookfield	1,016	None	– –
East Longmeadow	3,403	*Imhoff tank, trickling filter	Pecoosic Brook
Eastham	582	None	– –
Easthampton	10,316	Sedimentation tanks, sand filters	Manhan River
Easton	5,135	None	– –
Edgartown	1,370	None	– –
Egremont	463	None	– –
Erving	1,328	Dilution	Millers River
Essex	1,384	None	– –
Everett	46,784	North Metropolitan District	Boston Harbor
Fairhaven	10,938	Dilution	Acushnet River
Fall River	115,428	Dilution	Taunton River
Falmouth	6,878	None	– –
Fitchburg	41,824	Imhoff tanks, trickling filter, secondary tanks	Nashua River
Florida	421	None	– –
Foxborough	6,303	Sand filtration	Rumford River
Framingham	23,214	Imhoff tanks, sand filters	Bannister Brook
Franklin	7,303	Sedimentation tanks, sand filters (two disposal plants)	Mine and Timnah Brooks
Freetown	1,584	None	– –
Gardner	20,206	Sedimentation tanks, sand filters, (two disposal plants)	Otter River
Gay Head	127	None	– –
Georgetown	1,803	None	– –
Gill	931	None	– –
Gloucester	24,046	Dilution	Gloucester Harbor
Goshen	237	None	– –
Gosnold	136	None	– –
Grafton	7,457	None	– –
Granby	1,085	None	– –
Granville	668	None	– –
Great Barrington	5,824	Dilution	Housatonic River
Greenfield	15,672	Sedimentation, separate sludge digestion	Green River
Groton	2,550	None	– –
Groveland	2,122	None	– –
Hadley	2,576	None	– –
Halifax	867	None	– –
Hamilton	2,037	None	– –
Hampden	1,023	None	– –
Hancock	332	None	– –
Hanover	2,875	None	– –
Hanson	2,570	None	– –
Hardwick	2,154	Dilution	Ware River
Harvard	1,790	None	– –
Harwich	2,535	None	– –
Hatfield	2,216	Dilution	Mill River
Haverhill	46,752	Dilution	Merrimack River
Hawley	257	None	– –
Heath	359	None	– –
Hingham	8,003	None	– –
Hinsdale	1,235	Dilution	Housatonic River
Holbrook	3,330	None	– –
Holden	3,924	None	– –
Holland	247	None	– –
Holliston	3,000	None	– –
Holyoke	53,750	Dilution	Connecticut River
Hopedale	3,113	Septic tanks, sand filters	Mill River
Hopkinton	2,697	None	– –
Hubbardston	1,022	None	– –
Hudson	8,042	Sedimentation tanks, sand filters	Assabet River
Hull	2,167	Dilution	Nantasket Roads and Weir River
Huntington	1,340	Dilution	Westfield River
Ipswich	6,348	None	– –
Kingston	2,783	None	– –
Lakeville	1,780	None	– –
Lancaster	2,963	None	– –
Lanesborough	1,321	None	– –
Lawrence	84,323	Dilution	Merrimack River
Lee	4,222	Dilution	Housatonic River
Leicester	4,851	Sedimentation tank, sand filters	Town Meadow Brook
Lenox	2,884	Sedimentation tanks, sand filters	Housatonic River

(b) Certain local sewers with disposal works on mill property.
*Under construction.

Sewerage and Sewage Disposal in Massachusetts, 1940—Continued

City or Town	Population 1940	Means of Disposal	Sewage or Effluent Discharged into
Leominster	22,226	Grit chamber, preliminary sedimentation, activated sludge, secondary sedimentation, separate sludge digestion	Nashua River
Leverett	688	None	– –
Lexington	13,187	North Metropolitan District	Boston Harbor
Leyden	260	None	– –
Lincoln	1,783	None	– –
Littleton	1,651	None	– –
Longmeadow	5,790	Dilution	Connecticut River
Lowell	101,389	Dilution	Merrimack River
Ludlow	8,181	*Sedimentation, separate sludge digestion	Chicopee River
Lunenburg	2,195	None	– –
Lynn	98,123	Sea outfall	Lynn Harbor
Lynnfield	2,287	None	– –
Malden	58,010	North Metropolitan District	Boston Harbor
Manchester	2,472	Sea outfall	Atlantic Ocean
Mansfield	6,530	Imhoff tank, trickling filter, secondary sedimentation	Rumford River
Marblehead	10,856	Sea outfall	Atlantic Ocean
Marion	2,030	Sedimentation tanks, sand filters	Buzzards Bay
Marlborough	15,154	Sedimentation tanks, sand filters	Hop Brook
Marshfield	2,419	None	– –
Mashpee	434	None	– –
Mattapoisett	1,608	None	– –
Maynard	6,812	Imhoff tank, trickling filter, secondary sedimentation	Assabet River
Medfield	4,384	Sand filters	Charles River
Medford	63,083	North Metropolitan District	Boston Harbor
Medway	3,297	None	– –
Melrose	25,333	North Metropolitan District	Boston Harbor
Mendon	1,315	None	– –
Merrimac	2,320	None	– –
Methuen	21,880	Dilution	Spicket and Merrimack Rivers
Middleborough	9,032	Dilution	Nemasket River
Middlefield	201	None	– –
Middleton	2,348	None	– –
Milford	15,388	Imhoff tanks, sand and trickling filters, secondary sedimentation	Charles River
Millbury	6,983	None	– –
Millis	2,278	Sedimentation tanks, sand filters	Charles River
Millville	1,722	None	– –
Milton	18,708	South Metropolitan District	Boston Harbor
Monroe	207	None	– –
Monson	5,597	None	– –
Montague	7,582	Dilution	Connecticut River
Monterey	320	None	– –
Montgomery	178	None	– –
Mount Washington	57	None	– –
Nahant	1,835	Outfall sewers	Atlantic Ocean
Nantucket	3,401	Sand filters, (two disposal works)	Atlantic Ocean
Natick	13,851	Imhoff tank, trickling filter, secondary sedimentation	Bannister Brook
Needham	12,445	South Metropolitan District	Boston Harbor
New Ashford	87	None	– –
New Bedford	110,341	Outfall sewer	Buzzards Bay
New Braintree	439	None	– –
New Marlborough	956	None	– –
New Salem	357	None	– –
Newbury	1,599	None	– –
Newburyport	13,916	Dilution	Merrimack River
Newton	69,873	South Metropolitan District	Boston Harbor
Norfolk	2,294	None	– –
North Adams	22,213	Sedimentation tanks, sludge digestion	Hoosick River
North Andover	7,524	Dilution	Merrimack River
North Attleborough	10,359	Sedimentation tanks, sand filters	Ten Mile River
North Brookfield	3,304	Sand filters	Moore Brook
North Reading	2,886	None	– –
Northampton	24,794	Dilution	Mill River
Northborough	2,382	None	– –
Northbridge	10,242	Sedimentation tanks, sand filters	Blackstone River
Northfield	1,975	None	– –
Norton	3,107	None	– –
Norwell	1,871	None	– –
Norwood	15,383	South Metropolitan District	Boston Harbor
Oak Bluffs	1,584	None	– –
Oakham	423	None	– –
Orange	5,611	Dilution	Millers River
Orleans	1,451	None	– –
Otis	364	None	– –
Oxford	4,623	None	– –

*Under Construction

Sewerage and Sewage Disposal in Massachusetts, 1940—Continued

City or Town	Population 1940	Means of Disposal	Sewage or Effluent Discharged into
Palmer	9,149	Dilution	Quaboag River
Paxton	791	None	– –
PEABODY	21,711	South Essex Sewerage District	Salem Harbor
Pelham	568	None	– –
Pembroke	1,718	None	– –
Pepperell	3,114	None	– –
Peru	142	None	– –
Petersham	923	None	– –
Phillipston	481	None	– –
PITTSFIELD	49,684	Sedimentation tank, trickling and sand filters	Housatonic River
Plainfield	264	None	– –
Plainville	1,302	None	– –
Plymouth	13,100	Dilution	Plymouth Harbor
Plympton	532	None	– –
Princeton	713	None	– –
Provincetown	3,668	None	– –
QUINCY	75,810	South Metropolitan District	Boston Harbor
Randolph	7,634	None	– –
Raynham	2,141	None	– –
Reading	10,866	North Metropolitan District	Boston Harbor
Rehoboth	2,736	None	– –
REVERE	34,405	North Metropolitan District	Boston Harbor
Richmond	624	None	– –
Rochester	1,269	None	– –
Rockland	8,087	None	– –
Rockport	3,556	Sea outfall	Atlantic Ocean
Rowe	233	None	– –
Rowley	1,533	None	– –
Royalston	795	None	– –
Russell	1,242	None	– –
Rutland	2,181	None	– –
SALEM	41,213	South Essex Sewerage District	Salem Harbor
Salisbury	2,376	Outfall sewer	Black Rock Creek
Sandisfield	421	None	– –
Sandwich	1,360	None	– –
Saugus	14,825	Lynn outfall	– –
Savoy	300	None	– –
Scituate	4,130	None	– –
Seekonk	4,912	None	– –
Sharon	3,737	None	– –
Sheffield	1,709	None	– –
Shelburne	1,636	None	– –
Sherborn	1,022	None	– –
Shirley	2,608	None	– –
Shrewsbury	7,586	None	– –
Shutesbury	191	None	– –
Somerset	5,873	None	– –
SOMERVILLE	102,177	North Metropolitan District	Boston Harbor
South Hadley	6,856	Dilution	Connecticut River
Southampton	950	None	– –
Southborough	2,231	None	– –
Southbridge	16,825	Sedimentation tanks, sand filters	Quinebaug River
Southwick	1,579	None	– –
Spencer	6,641	Sand filters	Seven Mile River
SPRINGFIELD (2)	149,554	Sedimentation, separate sludge digestion	Connecticut River
Sterling	1,713	None	– –
Stockbridge	1,815	Sand filters	Housatonic River
Stoneham	10,765	North Metropolitan District	Boston Harbor
Stoughton	8,632	South Metropolitan District	Boston Harbor
Stow	1,243	None	– –
Sturbridge	2,227	None	– –
Sudbury	1,754	None	– –
Sunderland	1,085	None	– –
Sutton	2,749	None	– –
Swampscott	10,761	Sea outfall	Atlantic Ocean
Swansea	4,684	None	– –
TAUNTON	37,395	Dilution	Taunton River
Templeton	4,601	None	– –
Tewksbury	6,261	None	– –
Tisbury	1,966	None	– –
Tolland	129	None	– –
Topsfield	1,150	None	– –
Townsend	2,065	None	– –
Truro	585	None	– –
Tyngsborough	1,634	None	– –
Tyringham	213	None	– –
Upton	2,249	None	– –
Uxbridge	6,417	None	– –
Wakefield	16,223	North Metropolitan District	Boston Harbor
Wales	367	None	– –
Walpole	7,443	South Metropolitan District	Boston Harbor
WALTHAM	40,020	South Metropolitan District	Boston Harbor

Sewerage and Sewage Disposal in Massachusetts, 1940—Concluded

City or Town	Population 1940	Means of Disposal	Sewage or Effluent Discharged into
Ware	7,557	Dilution	Ware River
Wareham	6,364	None	– –
Warren	3,531	None	– –
Warwick	444	None	– –
Washington	267	None	– –
Watertown	35,427	South Metropolitan District	Boston Harbor
Wayland	3,505	None	– –
Webster	13,186	Dilution	French River
Wellesley	15,127	South Metropolitan District	Boston Harbor
Wellfleet	890	None	– –
Wendell	391	None	– –
Wenham	1,220	None	– –
West Boylston	1,822	None	– –
West Bridgewater	3,247	None	– –
West Brookfield	1,387	None	– –
West Newbury	1,515	None	– –
West Springfield	17,135	Dilution	Westfield River
West Stockbridge	1,062	None	– –
West Tisbury	260	None	– –
Westborough	6,463	Sand filters	Assabet River
WESTFIELD	18,793	Dilution	Westfield River
Westford	3,830	None	– –
Westhampton	403	None	– –
Westminster	2,126	None	– –
Weston	3,590	None	– –
Westport	4,134	None	– –
Westwood	3,376	None	– –
Weymouth	23,868	(c) None	– –
Whately	979	None	– –
Whitman	7,759	None	– –
Wilbraham	3,041	None	– –
Williamsburg	1,684	None	– –
Williamstown	4,294	Dilution	Hoosick River
Wilmington	4,645	None	– –
Winchendon	6,575	Sedimentation tanks, sand filters	Millers River
Winchester	15,081	North Metropolitan District	Boston Harbor
Windsor	314	None	– –
Winthrop	16,768	North Metropolitan District	Boston Harbor
WOBURN	19,751	North Metropolitan District	Boston Harbor
WORCESTER	193,694	Imhoff tanks, trickling filter, secondary sedimentation	Blackstone River
Worthington	471	None	– –
Wrentham	4,674	None	– –
Yarmouth	2,286	None	– –

(c) Member of South Metropolitan Sewerage District but has no service connections.

TABLE NO. 1.—*Average Results of the Analyses of Samples of Sewage as received at Disposal Works.*
(Parts per Million)

City or Town	Residue on Evaporation				Ammonia				Kjeldahl Nitrogen	Chlorides	Alkalinity	Iron		Fats	Oxygen Consumed	B.O.D.
	Total Residue		Loss on Ignition		Free	Albuminoid						Total	Dissolved			
	Total	*Suspended	Total	*Suspended		Total	Dissolved	Suspended								
Amherst	429	171	242	140	26.2	7.29	3.77	3.51	14.7	18	144	1.0	.27	74	59	265
ATTLEBORO	377	124	199	100	27.9	6.06	3.23	2.83	14.5	28	144	1.2	.47	49	63	161
Barnstable	560	252	313	182	28.9	7.37	3.82	3.55	14.3	52	161	0.5	.18	91	65	197
BROCKTON	688	227	346	188	48.0	7.97	4.68	3.29	16.3	83	214	0.9	.53	109	127	235
Clinton	630	246	388	208	24.8	8.20	4.40	3.80	17.9	56	128	1.7	.75	95	133	284
Concord	395	180	231	156	22.9	7.33	4.77	2.56	16.8	30	117	0.8	.35	82	67	197
Easthampton	452	165	265	129	33.1	6.20	4.17	2.03	15.6	35	189	0.7	.24	73	60	247
FITCHBURG	484	342	310	270	24.4	6.08	3.21	2.87	16.0	26	109	2.5	.60	132	69	204
Framingham[1]	624	244	341	184	38.0	9.05	6.45	2.60	20.5	42	238	1.4	.75	77	86	262
Framingham[2]	746	307	410	222	32.4	9.07	6.05	3.02	24.6	72	227	2.3	.63	112	116	317
Franklin	441	191	251	157	29.1	5.73	3.68	2.05	14.2	36	155	1.0	.29	80	58	166
GARDNER (Gardner Area)	656	257	404	221	45.3	9.43	5.85	3.58	20.3	58	195	1.3	.36	119	108	327
GARDNER (Templeton Area)	582	222	341	189	50.6	9.80	6.70	3.10	22.6	53	239	1.1	.48	86	82	230
Greenfield	489	220	268	174	20.7	4.94	2.99	1.95	12.2	32	155	1.6	.67	89	63	241
Hopedale	525	199	255	131	30.9	6.10	4.03	2.07	18.5	32	188	2.9	.37	81	97	183
Hudson	1178	865	743	642	40.9	13.50	6.52	6.98	31.0	64	226	2.6	.57	240	165	495
Leicester	311	75	149	63	16.4	3.39	1.96	1.43	11.7	23	117	0.4	.20	44	46	117
Lenox	831	336	541	235	20.1	8.07	4.03	4.04	20.6	28	223	1.7	.30	52	79	213
LEOMINSTER	372	149	201	119	22.6	5.19	2.38	2.81	11.2	48	112	0.8	.29	64	55	172
Marion	594	468	383	422	15.1	8.73	5.27	3.46	16.6	64	89	2.1	.51	183	67	169
MARLBOROUGH	651	319	406	271	35.4	11.20	6.19	5.01	23.6	44	199	2.3	.55	102	111	227
Maynard	658	386	395	324	44.2	11.20	5.92	5.28	24.5	47	201	1.6	.39	140	109	310
Medfield	558	246	314	201	18.4	9.03	5.48	3.55	21.9	26	142	1.0	.24	138	82	222
Milford	491	172	271	143	31.1	6.67	4.14	2.53	17.4	38	161	1.3	.38	83	73	200
Millis	185	12	68	10	8.7	1.17	0.98	0.19	3.9	19	85	0.5	.30	11	17	35
Natick	1176	785	787	622	33.3	11.10	4.57	6.53	27.1	42	232	2.8	.53	199	222	333
NORTH ADAMS	425	152	231	121	25.1	6.12	3.63	2.49	14.0	32	182	0.9	.26	57	58	221
North Attleborough	298	99	147	83	15.7	3.11	1.74	1.37	9.6	21	98	0.6	.22	42	45	67
Northbridge	389	174	238	149	26.7	5.48	3.46	2.02	16.0	28	126	1.6	.48	96	68	147
PITTSFIELD	444	178	246	145	20.4	5.92	3.92	2.00	13.3	44	178	1.8	.28	52	85	211
Southbridge	456	208	278	167	24.8	6.43	3.82	2.61	15.9	38	135	1.1	.47	77	75	242
Spencer	378	131	219	113	13.5	5.17	3.75	1.42	13.2	38	91	0.8	.40	51	57	135
Stockbridge	264	64	145	52	7.8	2.25	1.47	.78	5.5	14	128	0.6	.22	39	32	178
Westborough	450	156	262	134	25.6	6.50	4.31	2.19	16.0	32	142	0.7	.29	61	60	187
Winchendon	312	108	169	87	25.5	4.79	2.95	1.84	11.4	23	119	2.2	.69	55	44	128
WORCESTER	972	427	402	271	22.5	7.26	3.44	3.82	19.7	105	126	23.1	4.6	110	115	238

[1] Entrance to Imhoff tanks. [2] At Pumping Station. * Beginning 1937 determined by Gooch crucible method.

TABLE No. 2.—*Average Results of the Analyses of Samples of Sewage as Applied to Filter Beds after Preliminary Treatment*
(Parts per Million)

City or Town	Form of Preliminary Treatment	Residue on Evaporation: Total Residue: Total	Residue on Evaporation: Total Residue: Suspended	Residue on Evaporation: Loss on Ignition: Total	Residue on Evaporation: Loss on Ignition: Suspended	Ammonia: Free	Ammonia: Albuminoid: Total	Ammonia: Albuminoid: Dissolved	Ammonia: Albuminoid: Suspended	Kjeldahl Nitrogen	Chlorides	Alkalinity	Iron: Total	Iron: Dissolved	Fats	Oxygen Consumed	B. O. D.
Amherst	Sedim'n Tanks	353	62	156	56	25.5	4.85	3.37	1.48	9.6	23	149	0.7	.44	39	40	145
ATTLEBORO	None	377	124	199	100	27.9	6.06	3.23	2.83	14.5	28	144	1.2	.47	49	63	161
Barnstable	Imhoff Tank	417	59	199	42	34.3	4.00	2.81	1.19	10.8	64	201	1.4	.61	48	40	170
BROCKTON	Sedim'n Tanks	601	142	270	126	44.4	7.04	5.20	1.84	14.1	76	216	0.9	.53	80	117	178
Clinton	Sedim'n Basins	331	48	180	33	18.7	4.14	3.26	1.18	9.5	37	105	1.3	.83	27	61	132
Concord	None	395	180	231	156	22.9	7.33	4.77	2.56	16.8	30	117	0.8	.35	82	67	197
Easthampton	Sedim'n Tanks	387	105	200	88	31.8	5.70	3.66	2.04	13.2	36	183	0.6	.21	60	47	143
FITCHBURG	Imhoff Tanks	258	57	118	45	20.0	3.54	2.62	0.92	9.3	27	115	1.6	.66	27	36	82
Framingham	Imhoff Tanks	434	95	192	71	34.9	5.88	4.35	1.53	16.4	41	211	1.0	.55	46	50	182
Franklin	Sedim'n Tanks	261	49	97	34	26.0	3.81	2.78	1.03	10.6	27	129	1.2	.29	26	29	55
GARDNER (Gardner Area)	None	656	257	404	221	45.3	9.43	5.85	3.58	20.3	58	195	1.3	.36	119	108	327
GARDNER (Templeton Area)	Sedim'n Tanks	382	88	179	70	40.7	6.58	4.87	1.71	12.8	47	199	0.7	.34	52	52	193
Greenfield	Sedim'n Tanks	375	92	188	63	18.8	3.40	2.28	1.12	9.8	29	150	1.3	.80	54	42	178
Hopedale	Septic Tanks	286	78	113	62	29.7	3.87	3.11	0.76	11.4	28	147	0.9	.39	37	43	120
Hudson	Sedim'n Tanks	731	284	419	193	49.4	7.88	4.85	3.03	17.7	54	277	1.5	.55	147	89	368
Leicester	None	311	75	149	63	16.4	3.39	1.96	1.43	11.7	23	117	0.4	.20	44	46	117
Lenox	Sedim'n Tank	357	56	171	39	18.5	2.52	1.87	0.65	5.8	23	222	1.1	.43	32	31	112
LEOMINSTER	Sedim'n Tank	240	70	119	61	29.3	3.60	2.38	1.22	8.4	25	136	0.7	.26	32	35	104
Marion	Sedim'n Tanks	277	29	99	23	12.3	2.06	1.27	0.79	4.8	67	81	0.8	.47	31	26	59
MARLBOROUGH	Sedim'n Tanks	362	72	177	62	29.9	5.35	3.75	1.60	12.3	38	164	1.0	.45	45	49	123
Maynard	Imhoff Tank	438	136	284	112	55.0	7.82	5.53	2.29	19.3	62	258	1.1	.42	82	76	195
Medfield	None	558	246	314	201	18.4	9.03	5.48	3.55	21.9	26	142	1.0	.24	138	82	222
Milford	Imhoff Tank (Old)	334	61	151	52	28.8	4.18	2.91	1.27	11.0	34	151	0.9	.39	45	42	134
Milford	Imhoff Tank (New)	351	65	170	57	28.3	4.54	3.03	1.51	11.9	34	146	1.1	.55	41	43	170
Millis	None	185	12	68	10	8.7	1.17	0.98	0.19	3.9	19	85	0.5	.30	11	17	35
Natick	Imhoff Tank	574	146	284	103	29.6	4.78	3.17	1.61	15.5	50	219	1.0	.44	52	86	164
NORTH ADAMS	Sedim'n Tanks	330	71	175	57	19.6	3.51	2.57	0.94	9.3	25	172	0.5	.22	30	40	121
North Attleborough	Sedim'n Tanks	249	61	110	51	14.5	2.94	1.76	1.18	8.5	20	95	0.5	.22	22	31	58
Northbridge	Sedim'n Tanks	261	78	137	65	23.2	3.59	2.44	1.15	10.6	26	120	0.8	.42	42	39	110
PITTSFIELD	Sedim'n Tank	354	103	168	92	18.6	3.56	2.56	1.00	9.4	30	180	0.8	.41	44	44	131
Southbridge	Sedim'n Tanks	435	121	217	94	26.0	5.28	3.63	1.65	14.0	35	159	1.0	.57	61	58	212
Spencer	None	378	131	219	113	13.5	5.17	3.75	1.42	13.2	38	91	0.8	.40	51	57	135
Stockbridge	None	264	64	145	52	7.8	2.25	1.47	0.78	5.5	14	128	0.6	.22	39	32	178
Westborough	None	450	156	262	134	25.6	6.50	4.31	2.19	16.0	32	142	0.7	.29	61	60	187
Winchendon	Sedim'n Tanks	192	24	66	16	13.3	1.85	1.35	0.50	4.8	18	78	1.3	1.0	12	21	49
WORCESTER	Imhoff Tanks	620	140	165	90	28.9	3.45	2.02	1.43	10.9	88	104	18.2	7.7	48	54	105

TABLE No. 3.—*Efficiency of Settling Tanks and Other Forms of Preliminary Treatment as Indicated by the Foregoing Tables.*

(Parts per Million and Per Cent)

City or Town	Form of Preliminary Treatment	Detention Period (Hours)	Suspended Solids			Total Albuminoid Ammonia			Chlorides		Fats			Oxygen Consumed			B. O. D.		
			Raw Sewage	Settled or treated Sewage	Per Cent Removed	Raw Sewage	Settled or treated Sewage	Per Cent Removed	Raw Sewage	Settled or treated Sewage	Raw Sewage	Settled or treated Sewage	Per Cent Removed	Raw Sewage	Settled or treated Sewage	Per Cent Removed	Raw Sewage	Settled or treated Sewage	Per Cent Removed
Amherst	Sedim'n Tanks	–	171	62	64	7.28	4.85	33	18	23	74	39	47	59	40	32	265	145	45
Barnstable	Imhoff Tank	11.0	252	59	77	7.37	4.00	46	52	64	91	48	47	65	40	38	197	170	14
BROCKTON	Sedim'n Tanks	2.0	227	142	37	7.97	7.04	12	83	76	109	80	27	127	117	8	235	178	24
Clinton	Sedim'n Basins	7.3	246	48	80	8.20	4.44	46	56	37	95	27	72	133	61	54	284	132	54
Easthampton	Sedim'n Tanks	–	165	105	36	6.20	5.70	8	35	36	73	60	18	60	47	22	247	143	42
FITCHBURG	Imhoff Tanks	7.1	342	57	83	6.08	3.54	42	26	27	132	27	80	69	36	48	204	82	60
Framingham	Imhoff Tanks	3.5	244	95	61	9.05	5.88	35	42	41	77	46	40	86	50	42	262	182	31
Franklin	Sedim'n Tanks	8.3	191	49	74	5.73	3.81	34	36	27	80	26	68	58	29	50	166	55	67
GARDNER (Templeton Area)	Sedim'n Tanks	–	222	88	60	9.80	6.58	33	53	47	86	52	40	82	52	37	230	193	16
Greenfield	Sedim'n Tanks	–	220	92	58	4.94	3.40	31	32	29	89	54	39	63	42	33	241	178	26
Hopedale	Septic Tanks	–	199	78	61	6.10	3.87	37	32	28	81	37	54	97	43	56	183	120	34
Hudson	Sedim'n Tanks	15.5	865	284	67	13.50	7.88	42	64	54	240	147	39	165	89	46	495	368	26
Lenox	Sedim'n Tank	–	336	56	83	8.07	2.52	69	28	23	52	32	38	79	31	61	213	112	47
Leominster	Sedim'n Tank	1.6	149	70	53	5.19	3.60	31	48	25	64	32	50	55	35	36	172	104	40
Marion	Sedim'n Tanks	18.4	468	29	94	8.73	2.06	76	64	67	183	31	83	67	26	61	169	59	65
MARLBOROUGH	Sedim'n Tanks	5.1	319	72	77	11.20	5.35	52	44	38	102	45	56	111	49	56	227	123	46
Maynard	Imhoff Tank	6.1	386	136	65	11.20	7.82	30	47	62	140	82	41	109	76	30	310	195	37
Milford	Imhoff Tank (Old)	3.1	172	61	65	6.67	4.18	37	38	34	83	45	46	73	42	42	200	134	33
Milford	Imhoff Tank (New)	3.0	172	65	62	6.67	4.54	32	38	34	83	41	51	73	43	41	200	170	15
Natick	Imhoff Tanks	3.0	785	146	81	11.10	4.78	57	42	50	199	52	74	222	86	61	333	164	51
NORTH ADAMS	Sedim'n Tanks	2.4	152	71	53	6.12	3.51	43	32	25	57	30	47	58	40	31	221	121	45
No. Attleborough	Sedim'n Tanks	2.7	99	61	38	3.11	2.94	5	21	20	42	22	48	45	31	31	67	58	13
Northbridge	Sedim'n Tanks	1.8	174	78	55	5.48	3.59	34	28	26	96	42	56	68	39	43	147	110	25
PITTSFIELD	Sedim'n Tank	3.3	178	103	42	5.92	3.56	40	44	30	52	44	15	85	44	48	211	131	38
Southbridge	Sedim'n Tanks	5.7	208	121	42	6.43	5.28	18	38	35	77	61	21	75	58	23	242	212	12
Winchendon	Sedim'n Tanks	11.3	108	24	78	4.79	1.85	61	23	18	55	12	78	44	21	52	128	49	62
WORCESTER	Imhoff Tanks	2.7	427	140	67	7.26	3.45	52	105	88	110	48	56	115	54	53	238	105	56

TABLE NO. 4. — *Average Results of the Analyses of Sewage applied to the Trickling Filters at Brockton, Fitchburg, Framingham, Maynard, Milford, Natick, Pittsfield and Worcester, and their Effluents, etc. Per Cent Removed, etc.*

(Parts per Million)

Brockton

	Residue on Evaporation				Ammonia						Nitrogen as					
	Total Residue		Loss on Ignition			Albuminoid										
	Total	Suspended	Total	Suspended	Free	Total	Dissolved	Suspended	Kjeldahl Nitrogen	Chlorides	Nitrates	Nitrites	Fats	Oxygen Consumed	B. O. D.	Remarks
Settled sewage as applied to trickling filter.	601	142	270	126	44.4	7.04	5.20	1.84	14.1	76	–	–	80	117	178	Trickling filter has an area of 2.0 acres and a depth of 10 feet of stone from 1.5 to 3 inches in size. One half of filter used alternately.
Effluent from trickling filter.	518	116	196	93	30.6	4.58	2.23	2.35	11.2	78	–	–	33	67	32	The average rate of operation was about 1,385,000 gallons per acre per day.
Per cent removed.	14	18	27	26	31	35	57	–	21	—3			59	43	82	
Settled effluent from trickling filter as discharged to Taunton River.	505	74	164	62	30.2	3.59	2.20	1.39	9.3	77	11.96	0.25	31	54	22	Period of sedimentation about 1.5 hours.
Per cent removed by secondary settling tank.	3	36	16	33	1	22	1	41	17	1			6	19	31	Tanks cleaned 52 times.
Per cent removed by trickling filter and secondary settling tank.	16	48	39	51	32	49	58	24	34	–			61	54	88	

Fitchburg

Settled sewage as applied to trickling filter.	258	57	118	45	20.0	3.54	2.62	0.92	9.3	27	–	–	27	36	82	Trickling filter has an area of 2.14 acres and a depth of 10 feet of stone from 1 to 3 inches in size.
Effluent from trickling filter.	298	61	147	36	14.8	1.96	0.81	1.15	7.0	27	12.71	0.04	–	22	14	The average rate of operation was about 1,631,000 gallons per acre per day for area used (1.86 acres).
Per cent removed	–	–	–	20	26	45	69	–	25	0				39	83	
Settled effluent from trickling filter as discharged to Nashua River.	239	39	101	25	6.0	1.46	0.83	0.63	4.1	27	13.46	0.05	–	17	12	Period of sedimentation averaged about 1.5 hours.
Per cent removed by secondary settling tank.	20	36	31	31	59	26	–	45	41	0	–	–		23	14	
Per cent removed by trickling filter and secondary settling tank.	7	32	14	44	70	59	68	32	56	0				53	85	Tanks cleaned 6 times.

Framingham

Settled sewage as applied to trickling filter.	434	95	192	71	34.9	5.88	4.35	1.53	16.4	41	–	–	46	50	182	Trickling filter has an area of 0.56 of an acre and a depth of 7.5 feet of stone 2 inches in size.
Effluent from trickling filter.	392	92	156	65	16.1	3.50	2.11	1.39	9.7	42	11.79	0.52	–	35	40	The average rate of operation was about 1,662,000 gallons per acre per day.
Per cent removed.	10	3	19	8	54	40	51	9	41	–				30	78	
Settled effluent from trickling filter as discharged to Sudbury River.	428	111	174	72	15.9	3.67	1.99	1.68	9.5	47	11.20	0.36	–	33	42	Period of sedimentation averaged about 3.2 hours.
Per cent removed by secondary settling tank.	–	–	–	–	1	–	6	–	2	–	4	31	–	6	–	Tanks cleaned 4 times.
Per cent removed by trickling filter and secondary settling tank.	1	–	9	–	54	38	54	–	42	–				34	77	

TABLE No. 4.—*Average Results of the Analyses of Sewage applied to the Trickling Filters at Brockton, Fitchburg, Framingham, Maynard, Milford, Natick, Pittsfield and Worcester, and their Effluents, etc. Per Cent Removed, etc.*—Continued.

(Parts per Million)

Maynard

	Residue on Evaporation				Ammonia						Nitrogen as					
	Total Residue		Loss on Ignition			Albuminoid										
	Total	Suspended	Total	Suspended	Free	Total	Dissolved	Suspended	Kjeldahl Nitrogen	Chlorides	Nitrates	Nitrites	Fats	Oxygen Consumed	B. O. D.	Remarks
Settled sewage as applied to trickling filter.	438	136	284	112	55.0	7.82	5.53	2.29	19.3	62	–	–	82	76	195	Trickling filter has an area of 0.25 of an acre and a depth of 7 feet of stone from 1½ to 2½ inches in size.
Effluent from trickling filter.	425	114	208	82	32.8	5.03	2.45	2.58	11.4	53	14.32	0.26	–	45	34	The average rate of operation was about 724,000 gallons per acre per day.
Per cent removed.	3	16	27	27	40	36	56	–	41	15				41	83	
Settled effluent from trickling filter as discharged to Assabet River.	376	54	165	44	29.6	3.57	1.96	1.61	7.8	50	13.84	0.15	–	33	31	
Per cent removed by secondary settling tank.	12	53	21	46	10	29	20	38	32	6	3	42		27	9	
Per cent removed by trickling filter and secondary settling tank.	14	60	42	61	46	54	65	30	60	19				57	84	Tanks cleaned 4 times.

Milford

Settled sewage as applied to trickling filter.	343	63	161	55	28.6	4.36	2.97	1.39	11.5	34	–	–	43	43	152	Old trickling filter has an area of .28 of an acre and a depth of 6 feet of stone from 1 to 1¾ inches in size.
Effluent from trickling filter.	309	34	127	25	9.1	1.59	0.89	0.70	3.5	36	14.59	.07	–	16	13	New trickling filter has an area of .47 of an acre and a depth of 6 feet of stone from ¾ to 1½ inches in size.
Per cent removed.	10	46	21	55	68	64	70	50	70	–	–	–	–	63	91	
Settled effluent from trickling filter as discharged to Charles River	317	25	133	21	8.2	1.83	0.86	0.87	4.3	39	15.06	.07	–	17	13	The average rate of operation (old and new filters) was about 1,045,000 gallons per acre per day.
Per cent removed by secondary settling tank.	–	26	–	16	9	–	3	–	–	–	–	0	–	–	0	
Per cent removed by trickling filter and secondary settling tank.	8	60	17	62	71	58	71	37	63	–	–	–	–	60	91	New and old tanks each cleaned 13 times.

Natick

Settled sewage as applied to trickling filter.	574	146	284	103	29.6	4.78	3.17	1.61	15.5	50	–	–	52	86	164	Trickling filter has an area of .75 of an acre and a depth of 8 feet of stone from 1 to 2 inches in size.
Effluent from trickling filter.	468	97	196	64	5.0	2.68	1.18	1.50	8.5	48	17.00	.07	–	41	28	The average rate of operation was about 1,132,000 gallons per acre per day.
Per cent removed.	18	34	31	38	83	44	63	7	45	4	–	–	–	52	83	
Settled effluent from trickling filter as discharged to Bannister Brook.	472	68	197	46	5.0	2.19	1.25	0.94	7.5	48	16.10	.07	–	35	23	Period of sedimentation averaged about 2.0 hours.
Per cent removed by secondary settling tank.	–	30	–	28	0	18	–	37	12	0	5	0	–	15	18	
Per cent removed by trickling filter and secondary settling tank.	18	53	31	55	83	54	61	42	52	4	–	–	–	59	86	

TABLE NO. 4.—*Average Results of the Analyses of Sewage applied to the Trickling Filters at Brockton, Fitchburg, Framingham, Maynard Milford, Natick, Pittsfield and Worcester, and their Effluents, etc. Per Cent Removed, etc.*—Concluded

(Parts per Million)

Pittsfield

	Residue on Evaporation				Ammonia						Nitrogen as					
	Total Residue		Loss on Ignition			Albuminoid										
	Total	Suspended	Total	Suspended	Free	Total	Dissolved	Suspended	Kjeldahl Nitrogen	Chlorides	Nitrates	Nitrites	Fats	Oxygen Consumed	B. O. D.	Remarks
Settled sewage as applied to trickling filter.	354	103	168	92	18.6	3.56	2.56	1.00	9.4	30	–	–	44	44	131	Trickling filter has an area of 1.22 acres and a depth of 10 feet of stone from 1 to 2½ inches in size.
Effluent from trickling filter	333	34	141	27	3.59	1.25	0.73	0.52	2.9	30	12.51	.072	–	18	16	
Per cent removed.	6	67	16	71	81	65	71	48	69	0	–	–	–	59	88	
Settled effluent from trickling filter as discharged to Housatonic River.	351	24	194	20	1.3	1.34	0.80	0.54	2.8	26	15.1	.072	–	17	14.8	The average rate of operation was about 2,750,000 gallons per acre per day.
Per cent removed by secondary settling tank.	–	29	–	26	64	–	–	–	3	13	–	0	–	6	7	Period of sedimentation averaged about 2.1 hours.
Per cent removed by trickling filter and secondary settling tank.	1	77	–	78	93	62	69	46	70	13	–	–	–	61	89	

Worcester

Settled sewage as applied to trickling filter.	620	140	165	90	28.9	3.45	2.02	1.43	10.9	88	–	–	48	54	105	Trickling filters have an area of 13.68 acres and a depth of 10 feet of stone from 1 to 3 inches in size.
Effluent from trickling filter.	522	126	127	64	10.3	2.07	0.72	1.35	6.1	74	6.62	0.21	26	29	21	The average rate of operation was about 1,550,000 gallons per acre per day for area used (13.68 acres).
Per cent removed.	16	10	23	29	64	40	64	6	44	16	–	–	46	46	80	
Settled effluent from trickling filter as discharged to Blackstone River.	404	76	104	42	9.4	1.55	0.91	0.64	4.9	69	6.78	0.73	23	23	17	
Per cent removed by secondary settling tank.	23	40	18	34	9	25	–	53	20	7	–	–	12	21	19	Period of sedimentation averaged about 2.1 hours.
Per cent removed by trickling filter and secondary settling tank.	35	46	37	53	67	55	55	55	55	22	–	–	52	57	84	

Table No. 5.—*Average Results of Analyses of Samples of Effluent from Sand Filters*

(Parts per Million)

City or Town	Free Ammonia	Total Albuminoid Ammonia	Kjeldahl Nitrogen	Nitrogen as Nitrates	Nitrogen as Nitrites	Chlorides	Iron	B.O.D.
Attleboro	8.2	1.04	3.6	10.98	0.16	27	1.5	12
Brockton	16.5	1.06	2.4	8.58	0.10	64	2.8	17
Clinton	4.9	0.55	1.6	8.47	0.03	35	3.7	1
Concord	4.1	0.42	1.3	10.10	0.02	28	0.8	5
Easthampton	11.6	0.78	2.2	2.08	0.04	25	4.8	2
Franklin	5.2	0.92	2.4	11.53	0.02	30	0.7	5
Gardner (Gardner Area)	17.5	1.89	4.7	9.95	0.09	48	2.4	11
Gardner (Templeton Area)	18.8	1.69	3.9	14.29	0.17	44	1.7	36
Hopedale	12.2	0.91	1.7	12.42	0.02	27	0.2	1
Hudson	41.0	3.02	6.9	4.62	0.17	52	7.6	118
Leicester	10.4	1.21	2.8	4.21	0.09	21	2.4	23
Lenox	4.9	0.47	1.4	7.09	0.12	19	0.8	15
Marion	0.4	0.29	0.8	8.72	0.01	90	0.1	1
Marlborough	16.2	0.97	2.3	2.99	0.06	34	4.1	9
Medfield	9.0	2.58	5.4	5.24	0.20	16	1.3	70
Millis	0.2	0.10	0.4	15.60	0.01	22	0.1	1
North Attleborough	6.2	0.42	1.4	4.14	0.04	18	1.5	4
Northbridge	5.4	0.59	1.9	9.52	0.04	25	0.9	5
Pittsfield	10.3	2.06	4.0	6.64	0.09	27	2.5	36
Southbridge	24.3	1.32	3.0	2.10	0.04	33	4.3	19
Spencer (new beds)	6.9	0.88	2.0	14.35	0.11	28	5.9	19
Spencer (old beds)	6.0	0.35	0.7	0.99	0.01	20	6.2	8
Stockbridge	1.1	0.33	0.9	11.13	0.03	14	0.3	6
Westborough	5.6	1.88	3.1	9.08	0.14	22	1.2	14
Winchendon	5.0	0.31	0.9	8.10	0.04	21	2.1	1

Table No. 6.—*Efficiency of Sand Filters*

City or Town	Free Ammonia p.p.m. Applied Sewage	Free Ammonia p.p.m. Effluent	Free Ammonia Per Cent Removal	Total Albuminoid Ammonia p.p.m. Applied Sewage	Total Albuminoid Ammonia p.p.m. Effluent	Total Albuminoid Ammonia Per Cent Removal	Kjeldahl Nitrogen p.p.m. Applied Sewage	Kjeldahl Nitrogen p.p.m. Effluent	Kjeldahl Nitrogen Per Cent Removal	Chlorides p.p.m. Applied Sewage	Chlorides p.p.m. Effluent	B. O. D. p.p.m. Applied Sewage	B. O. D. p.p.m. Effluent	B. O. D. Per Cent Removal
Attleboro	27.9	8.2	71	6.06	1.04	83	14.5	3.6	75	28	27	161	12	93
Brockton	44.4	16.5	63	7.04	1.06	85	14.1	2.4	83	76	64	178	17	90
Clinton	18.7	4.9	74	4.44	0.55	88	9.5	1.6	83	37	35	132	1	99
Concord	22.9	4.1	82	7.33	0.42	94	16.8	1.3	92	30	28	197	5	97
Easthampton	31.8	11.6	64	5.70	0.78	86	13.2	2.2	83	36	25	143	2	99
Franklin	26.0	5.2	80	3.81	0.92	76	10.6	2.4	77	27	30	55	5	91
Gardner (Gardner Area)	45.3	17.5	61	9.43	1.89	80	20.3	4.7	77	58	48	327	11	97
Gardner (Templeton Area)	40.7	18.8	54	6.58	1.69	74	12.8	3.9	70	47	44	193	36	81
Hopedale	29.7	12.2	59	3.87	0.91	76	11.4	1.7	85	28	27	120	1	99
Hudson	49.4	41.0	17	7.88	3.02	62	17.7	6.9	61	54	52	368	118	68
Leicester	16.4	10.4	37	3.39	1.21	64	11.7	2.8	76	23	21	117	23	80
Lenox	18.5	4.9	74	2.52	0.47	81	5.8	1.4	76	23	19	112	15	87
Marion	12.3	0.4	97	2.06	0.29	86	4.8	0.8	83	67	90	59	1	99
Marlborough	29.9	16.2	46	5.35	0.97	82	12.3	2.3	81	38	34	123	9	93
Medfield	18.4	9.0	51	9.03	2.58	71	21.9	5.4	75	26	16	222	70	68
Millis	8.7	0.2	98	1.17	0.10	91	3.9	0.4	90	19	22	35	1	97
North Attleborough	14.5	6.2	57	2.94	0.42	86	8.5	1.4	84	20	18	58	4	93
Northbridge	23.2	5.4	77	3.59	0.59	84	10.6	1.9	82	26	25	110	5	95
Pittsfield	18.6	10.3	45	3.56	2.06	42	9.4	4.0	57	30	27	131	36	72
Southbridge	26.0	24.3	7	5.28	1.32	75	14.0	3.0	79	35	33	212	19	91
Spencer (new beds)	13.5	6.9	49	5.17	0.88	83	13.2	2.0	85	38	28	135	19	86
Spencer (old beds)	13.5	6.0	56	5.17	0.35	93	13.2	0.7	95	38	20	135	8	94
Stockbridge	7.8	1.1	86	2.25	0.33	85	5.5	0.9	84	14	14	178	6	97
Westborough	25.6	5.6	78	6.50	1.88	71	16.0	3.1	81	32	22	187	14	93
Winchendon	13.3	5.0	62	1.85	0.31	83	4.8	0.9	81	18	21	49	1	98

TABLE No. 7.—*Summary of Efficiency of Sewage Disposal Works. (Per Cent Removed from Raw Sewage to Final Effluent.)*

(Parts per Million and Per Cent)

City or Town	Suspended Solids			Free Ammonia			Total Albuminoid Ammonia			Kjeldahl Nitrogen			Chlorides		Oxygen Consumed			B.O.D.		
	Raw Sewage	Final Effluent	Per Cent Removed	Raw Sewage	Final Effluent	Per Cent Removed	Raw Sewage	Final Effluent	Per Cent Removed	Raw Sewage	Final Effluent	Per Cent Removed	Raw Sewage	Final Effluent	Raw Sewage	Final Effluent	Per Cent Removed	Raw Sewage	Final Effluent	Per Cent Removed
Amherst	171	62	64	26.2	25.5	3	7.28	4.85	33	14.7	9.6	35	18	23	59	40	32	265	145	45
ATTLEBORO	124	10	92	27.9	8.2	71	6.06	1.04	83	14.5	3.6	75	28	27	63	11	83	161	12	93
BROCKTON	227	9	96	48.0	16.5	66	7.97	1.06	87	16.3	2.4	85	83	64	127	19	85	235	17	93
Clinton	246	13	95	24.8	4.9	80	8.20	0.55	93	17.9	1.6	91	56	35	133	10	92	284	1	100
Concord	180	8	96	22.9	4.1	82	7.33	0.42	94	16.8	1.3	92	30	28	67	5	93	197	5	97
Easthampton	165	14	92	33.1	11.6	65	6.20	0.78	87	15.6	2.2	86	35	25	60	11	82	247	2	99
FITCHBURG	342	39	89	24.4	6.0	75	6.08	1.46	76	16.0	4.1	74	26	27	69	17	75	204	12	94
Framingham	244	111	55	38.0	15.9	58	9.05	3.67	59	20.5	9.5	54	42	47	86	33	62	262	42	84
Franklin	191	11	94	29.1	5.2	82	5.73	0.92	84	14.2	2.4	83	36	30	58	8	86	166	5	97
GARDNER (Gardner Area)	257	10	96	45.3	17.5	61	9.43	1.89	80	20.3	4.7	77	58	48	108	22	80	327	11	97
GARDNER (Templeton Area)	222	15	93	50.6	18.8	63	9.80	1.69	83	22.6	3.9	83	53	44	82	16	80	230	36	84
Greenfield	220	92	58	20.7	18.8	9	4.94	3.40	31	12.2	9.8	20	32	29	63	42	33	241	178	26
Hopedale	199	3	98	30.9	12.2	61	6.10	0.91	85	18.5	1.7	91	32	27	97	10	90	183	1	99
Hudson	865	49	94	40.9	41.0	–	13.50	3.02	78	31.0	6.9	78	64	52	165	36	78	495	118	76
Leicester	75	11	85	16.4	10.4	37	3.39	1.21	64	11.7	2.8	76	23	21	46	15	67	117	23	80
Lenox	336	4	99	20.1	4.9	75	8.07	0.47	94	20.6	1.4	93	28	19	79	8	90	213	15	93
LEOMINSTER	149	13	91	22.6	20.1	11	5.19	1.33	74	11.2	2.9	74	48	21	55	12	78	172	9	95
Marion	468	6	99	15.1	0.4	97	8.73	0.29	97	16.6	0.8	95	64	90	67	5	93	169	1	99
MARLBOROUGH	319	14	96	35.4	16.2	54	11.20	0.97	91	23.6	2.3	90	44	34	111	15	86	227	9	96
Maynard	386	54	86	44.2	29.6	33	11.20	3.57	68	24.5	7.8	68	47	50	109	33	70	310	31	90
Medfield	146	36	85	18.4	9.0	51	9.03	2.58	71	21.9	5.4	75	26	16	82	28	66	222	70	68
Milford	172	25	85	31.1	8.2	74	6.67	1.83	73	17.4	4.3	75	38	39	73	14	81	200	13	94
Millis	12	7	42	8.7	0.2	98	1.17	0.10	91	3.9	0.4	90	19	22	17	4	76	35	1	97
Natick	785	68	91	33.3	5.0	85	11.10	2.19	80	27.1	7.5	72	42	48	222	35	84	333	23	93
NORTH ADAMS	152	71	53	25.1	19.6	22	6.12	3.51	43	14.0	9.3	34	32	25	58	40	31	221	121	45
North Attleborough	99	6	94	15.7	6.2	61	3.11	0.42	86	9.6	1.4	85	21	18	45	6	87	67	4	94
Northbridge	174	9	95	26.7	5.4	80	5.48	0.59	89	16.0	1.9	88	28	25	68	7	90	147	5	97
PITTSFIELD	178	24	87	20.4	1.3	94	5.92	1.34	77	13.3	2.8	79	44	26	85	17	80	211	15	93
Southbridge	208	18	91	24.8	24.3	2	6.43	1.32	79	15.9	3.0	81	38	33	75	11	85	242	119	93
Spencer (new beds)	131	57	56	13.5	6.9	49	5.17	0.88	83	13.2	2.0	85	38	28	57	10	82	135	19	86
Spencer (old beds)	131	13	90	13.5	6.0	56	5.17	0.35	93	13.2	0.7	95	38	20	57	8	86	135	8	94
Stockbridge	64	6	91	7.8	1.1	86	2.25	0.33	85	5.5	0.9	84	14	14	32	6	81	178	6	97
Westborough	156	12	92	25.6	5.6	78	6.50	1.88	71	16.0	3.1	81	32	22	60	12	80	187	14	93
Winchendon	108	11	90	25.5	5.0	80	4.79	0.31	94	11.4	0.9	92	23	21	44	6	87	128	1	99
WORCESTER	427	76	82	22.5	9.4	58	7.26	1.55	79	19.7	4.9	75	105	69	115	23	80	238	17	93

TABLE NO. 8.—*Extent of Sewage Works, Rate of Flow, and Rate of Operation of Filters*

City or Town	Population, Census of 1940	Approximate Length of Sanitary Sewers (Miles)	Approximate Number of House Connections	Estimated Quantity of Sewage Treated (Gallons per Day): Average for Year	Average for Month of Maximum Flow	Average for Month of Minimum Flow	Estimated Quantity of Sewage per Connection (Gallons per Day)	Net Area of Filter Beds (Acres)	Estimated Rate of Operation with Even Distribution. (Gallons per Acre per Day)
Amherst	6,410	–	906	495,000[7]	717,000	320,000	546	–	–
ATTLEBORO	22,071	38.58	1,985	951,000	2,427,000	530,000	479	15.50	61,000
Barnstable	8,333	3.87	116	73,000	123,000	46,000	629	4.13	18,000
BROCKTON	62,343	116.15	8,946	3,119,000	4,565,000	2,530,000	349	37.00*	–
Clinton	12,440	26.18	1,965	1,483,000[2]	2,605,000	986,000	755	26.23	57,000
Concord	7,972	17.72	815	529,000	938,000	372,000	649	7.41	71,000
Easthampton	10,316	30.01	1,324	–	–	–	–	2.20	–
FITCHBURG	41,824	69.07	–	3,034,000	5,017,000	2,090,000	–	–*	–
Framingham	23,214	54.61	3,968	1,494,000	2,302,000	1,097,000	377	–*	–
Franklin	7,303	14.27	879	238,000	286,000	–	271	3.24	73,000
GARDNER	20,206	39.99	2,722	–	–	–	–	16.50	–
Greenfield	15,672				–	–	–	–	–
Hopedale	3,113	7.08	370	221,000[3]	370,000	170,000	597	3.79	58,000
Hudson	8,042	14.96	1,187	620,000	1,094,000	510,000	522	9.00	69,000
Leicester	4,851	4.00	160	–	–	–	–	0.73	–
Lenox	2,884	10.59	406	–	–	–	–	2.50	–
LEOMINSTER	22,226	50.77	–	1,940,000	3,594,000	1,440,000	–	–**	–
Marion	2,030	4.84	280	141,000	219,000	76,000	504	1.53	92,000
MARLBOROUGH	15,154	36.95	2,695	1,363,000	2,650,000	841,000	506	20.19	68,000
Maynard	6,812	12.54	812	181,000	260,000	156,000	223	–*	–
Medfield	4,384	2.75	151	–	–	–	–	1.61	–
Milford	15,388	26.15	1,918	784,000	1,066,000	560,000	409	–	–
Millis	2,278	1.50	16	–	–	–	–	1.12	–
Nantucket	3,401	22.75	1,663[4]	650,000	799,000	521,000	391	8.00[5]	81,000
Natick	13,851	14.72	1,724	849,000	1,630,000	572,000	492	–*	–
NORTH ADAMS	22,213	38.55	5,205	2,411,000	3,388,000	1,771,000	463	–	–
North Attleborough	10,359	18.16	1,138	857,000[8]	–	750,000	753	8.75	98,000
Northbridge	10,242	16.24	1,036	1,128,000	1,360,000	874,000	1,089	12.00	94,000
PITTSFIELD	49,684	94.60	7,451	4,833,000	6,719,00	4,072,000	649	–*	–
Southbridge	16,825	28.19	2,013	924,000	1,084,000	733,000	459	10.95	84,000
Spencer	6,641	10.52	870	614,000	972,000	467,000	706	12.30	50,000
Stockbridge	1,815	4.02	250	–	–	–	–	–	–
Westborough	6,463	8.75	616	408,000	980,000	273,000	662	6.62	62,000
Winchendon	6,575	16.86	508	187,000	293,000	138,000	368	4.00	47,000
WORCESTER	193,694	258.43[6]	31,257	21,750,000	32,790,000	16,680,000	696	–*	–

[1] Includes an average of 2,771,000 gallons per day to trickling filter and 348,000 gallons to sand filters.
[2] Entire quantity of sewage not treated.
[3] New development not included in average.
[4] Four miles of sewers and 184 connections in addition in Siasconset.
[5] No underdrains. Filters drain direct to ocean.
[6] Includes 70.2 miles of combined sewers.
[7] Ave. May to Dec. inclusive
[8] Based on 10 months' flow; flow in 2 months in excess of measuring capacity.
* For trickling filter data see Table No. 4.
** Activated sludge plant.

TABLE NO. 9—*General Features*

CITY OR TOWN	Year of Construction of and Additions to Works	Depth of Underdrains (Feet)	Distance Apart of Underdrains (Feet)	Type of Plant	Attention Given to Disposal Works
Amherst	1940			Preliminary settling tanks; sludge digestion	One full-time operator; one man in summer.
ATTLEBORO	1912, 1913	4–7	35	Sand filters; material found in place	One man all the time; others when necessary.
Barnstable	1936	3	50	Sand filters; material found in place	One man every day; others when necessary.
BROCKTON	1893, 1905, 1908, 1912	5.5	30	Sand filters; material found in place; trickling filter. (See Table No. 4)	Chemist in charge, 1 assistant chemist, foreman, day and night men; more when necessary.
Clinton	1898, 1899	8	60–70	Sand filters; material found in place	Four men all the time; others when necessary.
Concord	1899, 1928, 1934	none	–	Sand filters; material found in place	One man once a day.
Easthampton	1908	3.5	20–40	Sand filters; material largely found in place	One man all the time; others when necessary.
FITCHBURG	1914	–	–	Trickling filter. (See Table No. 4)	Chemist in charge; 1 foreman, 1 day and 2 night men.
Framingham	1890, 1924, 1933 1938	–	–	Sand filters; trickling filters. (See Table No. 4)	One man all the time; others when necessary.
Franklin	1915	4.5	26	Sand filters	Very little attention; one man once in a while.
GARDNER (Gardner Area)	1891	5	20	Sand filters }	One man all the time; others when necessary.
GARDNER (Templeton Area)	1901, 1909, 1931	3–4	20–30	Sand filters }	
Greenfield	1940	–	–	Preliminary settling tanks; sludge digestion	One full-time operator; one man in summer.
Hopedale	1900, 1923	3	35–60	Sand filters	One man all the time; others when necessary.
Hudson	1904, 1910	5–6	50–100	Sand filters; material found in place	One man all the time; others when necessary.
Leicester	1894, 1928, 1939	4	8	Sand filters	Very little attention.
Lenox	1888	4	12	Sand filters	One man all the time; one man in summer.
Leominster	1937	–	–	Activated sludge	Chemist and three men part time; one operator full time.
Mansfield	1940	–	–	Trickling filter. (See Table No. 4)	One man part time.
Marion	1906, 1930	5	–	Sand filters; material largely found in place	One man all the time; others when necessary.
MARLBOROUGH	1891, 1908 1909, 1910, 1911	4.5–6	30–50	Sand filters; material found in place	One man all the time; others when necessary.
Maynard	1929	–	–	Trickling filter. (See Table No. 4)	One man all the time.
Milford	1907, 1924, 1936	5	40	Sand filters; material found in place; trickling filters. (See Table No. 4)	Three men every day; others when necessary.
Nantucket	1930	–	–	Sand filters; material found in place	Two men every day in summer; others when necessary.
Natick	1896,[1] 1935	–	–	Trickling filter. (See Table No. 4)	One man all the time; others when necessary.
NORTH ADAMS	1935	–	–	Preliminary settling tanks; sludge digestion	Two men all the time.
North Attleborough	1909, 1910, 1931	5–6.5	55	Sand filters; material found in place	One man every day; others when necessary.
Northbridge	1906, 1907, 1920	4	50–75	Sand filters; material mostly handled	One man all the time; others when necessary.
PITTSFIELD	1901, 1915, 1937	4	35	Sand filters; trickling filter. (See Table No. 4)	Foreman and five laborers all the time.

[1]Sand filters abandoned Nov., 1935. Imhoff tank, trickling filter and secondary tank installed.

Table No. 9—*General Features*—Continued

City or Town	Year of Construction of and Additions to Works	Depth of of Under-drains (Feet)	Distance Apart of Under-drains (Feet)	Type of Plant	Attention Given to Disposal Works
Southbridge	1908, 1925, 1926	4	40	Sand filters; some material found in place.	One man all the time.
Spencer	1897, 1923, 1935	4	–	Sand filters; material largely found in place	One man all the time; others when necessary.
Springfield—Main Plant	1940	–	–	Preliminary settling tanks; sludge digestion; incineration	Superintendent, chief chemist, one assistant chemist, superintendent sludge disposal, eight engineer attendants, six laborers.
Indian Orchard	1940	–	–	Preliminary settling tanks; sludge digestion	Above technical personnel, three engineer attendants, one assistant chemist, one laborer.
Stockbridge	1899, 1921, 1922	3–4.5	23–30	Irrigation area; sand filters	One man all the time; one man in summer.
Westborough	1892, 1911	5	30–40	Sand filters	One man all the time; others when necessary.
Winchendon	1928	–	–	Sand filters; material found in place	One man part time.
Worcester	1898[?],[3], 1925	–	–	Trickling filters. (See Table No. 4)	Chemist in charge; two assistant chemists; foreman, day and night men.

[?]Year of first construction of sand filters. Many additions.

[3]Sedimentation tanks and sand beds abandoned 1925. Imhoff tanks, trickling filters and secondary tanks installed.

Examination of Sewer Outlets Discharging into the Sea

As required by law, the Division has caused examinations to be made of the main outlets of sewers in tidewater and in connection with this work use was made of a boat kindly supplied by the Department of Conservation. Under ordinary circumstances, samples are not collected of the sewage discharging into the sea with the exception of that discharged into Boston Harbor and that from the South Essex Sewerage District.

Some progress has been made in Plymouth in the construction of an intercepting sewer by means of which the sewage from certain outlets will be conveyed to a single point for discharge into Plymouth Harbor. This sewer is a part of a plan for the ultimate collection and proper disposal of the sewage.

Several conferences have been held with the officials of the city of Fall River relative to the treatment of the sewage of that city, but with no tangible results.

Several conferences have been held with the Swampscott authorities relative to the installation of proper screens or other devices for removing solid matters from this sewage and a written notice of the Department was sent to this municipality requiring more adequate treatment of the sewage discharged.

The examinations have shown no objectionable conditions in the vicinity of the Rockport and Manchester sewer outlets, but at Gloucester large quantities of sewage matters were present on the surface of the sea over the outfall and a leak was observed in the main outfall about 750 feet inside the outfall. The Department has recommended that action be taken by the city relative to repairing the leak and to the installation of devices for the proper removal of objectionable solids from the sewage. It is understood that the city is to consult with engineers in regard to this matter.

The conditions in the vicinity of the outlet of the South Essex Sewerage District, while objectionable to persons using the waters of Salem Harbor for recreational purposes, were not different from other years and no complaint relative to the discharge of sewage from this outlet was received by the Department during the year.

Examinations off Marblehead showed that the outlet of this municipality is a satisfactory one.

Foul materials were found on the surface of the sea over the Lynn outlet, but there was no evidence that this material reached the shore line.

An examination of the New Bedford main sewer outlet showed that it was operating satisfactorily.

There are various communities along the coast line of Massachusetts which use the tidal waters for sewage disposal and where the outlets are not located in suitable currents nor in deep water. Some improvement is necessary in the method of sewage disposal at Salisbury Beach particularly in connection with the Salisbury Beach Reservation. The larger communities along the sea coast where suitable means of sewage disposal have not yet been provided are Newburyport, the Metropolitan sewerage districts and Boston, Hull, Plymouth, Mattapoiset and Fall River. The sewage from these municipalities badly affects local bathing places and seriously endangers shellfish-growing areas. The Department has authority to prevent new sources of pollution of the tidal waters adjacent to Barnstable, Dukes and Nantucket counties but thus far has not been clothed with authority regarding the tidal waters adjacent to other counties. Suitable legislation would assist the Department in the protection of the public health in these matters.

Other municipalities along the coastline which have no sewerage systems, nevertheless discharge sewage into surface water drains entering tidal waters or otherwise pollute tidal waters in such a way as to seriously endanger shellfish growing areas. Among these municipalities should be mentioned the towns of Ipswich, Weymouth, Hingham, Cohasset, Scituate, Provincetown, Falmouth, and Wareham, where sewerage systems with suitable means of sewage disposal have been recommended by the Department.

Shellfish

The Department has carried on its usual work required under General Laws, Chapter 130, on shellfish matters. During the past year restrictions were placed on the taking of shellfish from the following areas:

Gloucester—redefined closed area	May 15, 1940
Gloucester—closed Lanes Cove	Nov. 25, 1940
Manchester—closed Inner Harbor	Jan. 3, 1940
Manchester—closed Outer Harbor	July 22, 1940
Mount Hope Bay—redefined closed area	June 13, 1940

Restrictions were removed from the following area:

A portion of Stony Beach in the town of Hull . . .	Oct. 24, 1940
Temporary removal of restrictions on Boynton's Flats, Gloucester	Dec. 16, 1940
A portion of Manchester Harbor	Dec. 16, 1940

The following additional moderately polluted areas were approved for the taking of shellfish for purification purposes:

Dartmouth—Apponaganset River	Oct. 22, 1940
Boston Harbor—B. H. 5A Westerly shore of Squantum .	Oct. 3, 1940
Boston Harbor—B. H. 4 in South Boston and B. H. 5 in Quincy	Oct. 23, 1940
Plymouth Harbor—P. H. 6	Nov. 15, 1940
Gloucester—Additional area in Mill River	Dec. 19, 1940

Samples have been collected at frequent intervals of shell oysters shipped to Massachusetts growers for fattening in the waters in the vicinity of Cape Cod. These results have generally been satisfactory during the year.

The Department has maintained close supervision of the operation of the shellfish purification plants at Scituate and Newburyport, but on March 26, 1940, the approval of the Scituate plant was withdrawn because of faulty operations and this plant has not since been in operation. The quantity of shellfish handled at the two plants during 1940 is shown in the following table:

Quantity in Barrels of Shellfish Treated During Last Five Years

Year	Newburyport		Plymouth		Scituate		Total
	Clams	Quahogs	Clams	Quahogs	Clams	Quahogs	
1936 . .	6,260	–	3,442	–	–	–	9,702
1937 . .	7,769.4	–	–	–	1,330.1	69.7	9,169
1938 . .	8,526	–	–	–	2,003	1,729	12,258
1939 . .	13,147⅓	–	–	–	5,304⅔	2,743$^{5}/_{9}$	21,195
1940 . .	17,816⅛	–	–	–	2,150⅓	1,001½	20,968
Total .	53,519	–	3,442	–	10,788	5,543.5	73,292

No cases resulting from the handling of polluted shellfish were brought into the courts during 1940, in part because of the unsatisfactory results of such cases due to the simplicity of defense afforded under the provisions of General Laws, Chapter 94, Section 194A. The Department has done what it could to keep sewage contaminated shellfish off the markets, but it cannot be wholly successful until the said Section 194A is repealed. Continuation of this law must inevitably result in depreciation of the value of Massachusetts shellfish products.

The following table shows the number of out-of-state shellfish certificates approved during the last five years:

1936	316
1937	323
1938	231
1939	214
1940	191

Examinations were made of 265 shucking plants for certification purposes during the year 1940. The number of routine and special inspections of shellfish-handling establishments as made during the last five years is shown in the following table:

1936	1,216
1937	1,496
1938	1,697
1939	2,132
1940	1,716

In connection with the inspections, particularly of shucking plants, the Department has formally requested the Director of the Division of Marine Fisheries to revoke the certificates of the following number of shellfish-handling establishments during the last five years:

1936	27
1937	8
1938	29
1939	27
1940	11

Cross Connections

During the latter part of the year 1936 the full-time services of an engineer were made available from funds from the U. S. Public Health Service for the study of cross connections between public water supplies and fire and industrial water supplies.

An extensive investigation relative to cross connections was carried on during 1936 and under date of February 9, 1937, the Department, under the authority of Section 160, Chapter 111, of the General Laws, adopted rules and regulations relative to cross connections between public water supplies and fire and industrial water supplies. During 1937 the investigation was continued and the necessity of removing or properly protecting all cross connections in accordance with the new rules and regulations was pointed out to the authorities in charge of industrial plants and to local water works and health officials. Arrangements were made with the water works officials for their cooperation in the inspection of double check valves installed for the protection of cross connections and for such water departments to make quarterly tests of check valve installations supplemented by monthly tests by the owners and annual tests by the Department of Public Health.

The following table summarizes the work of the Division of Sanitary Engineering since 1936 relative to double check valve inspection. There also follows a table showing the detailed report of double check valve routine tests during 1940.

During the current year the investigations of this Division have continued in connection with the examination of piping conditions in industrial plants so far as they relate to cross connections between secondary water supplies used for fire and industrial purposes and water supplies used for drinking purposes, and these have included swimming and wading pools as was the case in 1939.

Inspections of Double Check Valves

Year	*Inspections by Water Departments*	*Inspections by State Department of Public Health*
1936	–	Investigation
1937	–	209
1938	517	415
1939	1382	789
1940	1429	799

Detailed Report of Double Check Valve Routine Tests—1940

	Inspections by Water Departments	*Inspections by State Department of Public Health*
Fire service	568	285
Industrial supplies	630	341
Fire and industrial supplies	203	154
Swimming pools	28	19
Total	1,429	799
Number of check valves which tested satisfactorily	1,357	623
*Number of check valves which were found leaking	58	164
†Number of check valves which tested unsatisfactory	14	12
Total	1,429	799

*Check valves found leaking which after overhauling were made to operate satisfactorily.
†Check valves which could not be made to operate satisfactorily.

The total number of plants examined, which included 799 examinations of sets of double check valve installations varying in size from ¾-inch to 12-inch, are shown in the following tables, together with the details for such inspections in the past fiscal year. Double check valve installations were found to be satisfactory at 78 per cent of the initial tests and except in one or two cases were left in a satisfactory condition at the time of the inspection.

Total Plant Examinations		1,103
Plants at which cross connections were found		865
Plants at which cross connections were protected by double check valve installations	497	
Plants at which a part of the cross connections were protected by double check valves	68	
Plants at which cross connections were not protected and owners notified to protect	300	
	865	
Double Check Valve Installations		
Total installations November 30, 1940 (at 523 plants in 121 municipalities)		820
Total installations examined		769
Total inspections made including two inspections at 30 installations		799

Re-Establishment of Boundaries of Sanitary Engineering Districts

During the year 1940 the large volume of work which the Division of Sanitary Engineering was directed to carry out necessitated the establishment of a new sanitary engineering district which is known as the Easterly District. This district was made up of parts of the former Northeasterly District, Southeasterly District and Central District. In addition certain changes were made in the boundary line between the Westerly and Central Districts. Under the present arrangements the five engineering districts now include the following municipalities:

Eastern Sanitary Engineering District

William H. Doggett: Home Address—Sandy Valley Road, Dedham, Mass.
Telephone —Dedham 0062–M

Office Address—511A State House, Boston, Mass.
Telephone —Capitol 4600—Extension 330

Abington
Acton
Arlington
Ashland
Avon
Belmont
Bellingham
Boston
Braintree
Brockton
Brookline
Cambridge
Canton
Chelsea
Cohasset
Concord
Dedham
Dover
East Bridgewater
Easton
Everett
Foxborough
Framingham
Franklin
Hanover
Hingham
Holbrook
Holliston
Hopkinton
Hull
Lexington
Lincoln
Malden
Marshfield
Maynard
Medfield
Medford
Medway
Millis
Milton
Natick
Needham
Newton
Norfolk
Norwell
Norwood
Quincy
Randolph
Revere
Rockland
Scituate
Sharon
Sherborn
Somerville
Stoughton
Sudbury
Walpole
Waltham
Watertown
Wayland
Wellesley
West Bridgewater
Weston
Westwood
Weymouth
Whitman
Winchester
Winthrop
Wrentham

Central Sanitary Engineering District

Harry E. Holmes: Home Address—181 Glenwood St., Malden, Mass.
Telephone —Malden 0638

Office Address—511A State House, Boston, Mass.
Telephone —Capitol 4600—Extension 331

Ashburnham
Ashby
Auburn
Ayer
Barre
Berlin
Blackstone
Bolton
Boxborough
Boylston
Brookfield
Charlton
Clinton
Douglas
Dudley
Dunstable
East Brookfield
Fitchburg
Gardner
Grafton
Groton
Hardwick
Harvard
Holden
Hopedale
Hubbardston
Hudson
Lancaster
Leicester
Leominster
Littleton
Lunenburg
Marlborough
Mendon
Milford
Millbury
Millville
New Braintree
Northborough
North Brookfield
Northbridge
Oakham
Oxford
Paxton
Pepperell
Princeton
Rutland
Shirley
Shrewsbury
Southborough
Southbridge
Spencer
Sterling
Stow
Sturbridge
Sutton
Townsend
Tyngsborough
Upton
Uxbridge
Warren
Webster
West Boylston
West Brookfield
Westborough
Westminster
Worcester

Southeastern Sanitary Engineering District

William R. Clary: Home Address—11 Higgins St., Arlington, Mass.
Telephone —Arlington 2355-M

Office Address—511A State House, Boston, Mass.
Telephone —Capitol 4600—Extension 333

Acushnet
Attleboro
Barnstable
Berkley
Bourne
Brewster
Bridgewater
Carver
Chatham
Chilmark
Dartmouth
Dennis
Dighton
Duxbury
Eastham
Edgartown
Fairhaven
Fall River
Falmouth
Freetown
Gay Head
Gosnold
Halifax
Hanson
Harwich
Kingston
Lakeville
Mansfield
Marion
Mashpee
Mattapoisett
Middleborough
Nantucket
New Bedford
North Attleborough
Norton
Oak Bluffs
Orleans
Pembroke
Plainville
Plymouth
Plympton
Provincetown
Raynham
Rehoboth
Rochester
Sandwich
Seekonk
Somerset
Swansea
Taunton
Tisbury
Truro
Wareham
Wellfleet
West Tisbury
Westport
Yarmouth

Northeastern Sanitary Engineering District

Ernest J. Sullivan: Home Address—153 Paradise Road, Swampscott, Mass.
Telephone —Lynn 3-2008

Office Address—511A State House, Boston, Mass.
Telephone —Capitol 4600—Extension 333

Amesbury	Ipswich	Reading
Andover	Lawrence	Rockport
Bedford	Lowell	Rowley
Beverly	Lynn	Salem
Billerica	Lynnfield	Salisbury
Boxford	Manchester	Saugus
Burlington	Marblehead	Stoneham
Carlisle	Melrose	Swampscott
Chelmsford	Merrimac	Tewksbury
Danvers	Methuen	Topsfield
Dracut	Middleton	Wakefield
Essex	Nahant	Wenham
Georgetown	Newbury	West Newbury
Gloucester	Newburyport	Westford
Groveland	North Andover	Wilmington
Hamilton	North Reading	Woburn
Haverhill	Peabody	

Western Sanitary Engineering District

Clarence I. Sterling, Jr.: Home Address—6 State St., Westfield, Mass.
Telephone —Westfield 2127

Office Address—Westfield State Sanatorium, Westfield, Mass.
Telephone —Springfield 6-4253

Adams	Goshen	New Ashford
Agawam	Granby	New Marlborough
Alford	Granville	New Salem
Amherst	Great Barrington	North Adams
Ashfield	Greenfield	Northampton
Athol	Hadley	Northfield
Becket	Hampden	Orange
Belchertown	Hancock	Otis
Bernardston	Hatfield	Palmer
Blandford	Hawley	Pelham
Brimfield	Heath	Peru
Buckland	Hinsdale	Petersham
Charlemont	Holland	Phillipston
Cheshire	Holyoke	Pittsfield
Chester	Huntington	Plainfield
Chesterfield	Lanesborough	Richmond
Chicopee	Lee	Rowe
Clarksburg	Lenox	Royalston
Colrain	Leverett	Russell
Conway	Leyden	Sandisfield
Cummington	Longmeadow	Savoy
Dalton	Ludlow	Sheffield
Deerfield	Middlefield	Shelburne
East Longmeadow	Monroe	Shutesbury
Easthampton	Monson	South Hadley
Egremont	Montague	Southampton
Erving	Monterey	Southwick
Florida	Montgomery	Springfield
Gill	Mount Washington	Stockbridge

Sunderland	Washington	Wilbraham
Templeton	Wendell	Williamsburg
Tolland	West Springfield	Williamstown
Tyringham	West Stockbridge	Winchendon
Wales	Westfield	Windsor
Ware	Westhampton	Worthington
Warwick	Whately	

Recreational Camps, Overnight Camps or Cabins and Trailer Camps

Chapter 416 of the Acts of 1939 requires the licensing by the local boards of health of all recreational camps, overnight camps or cabins and trailer camps. This law specifies that the local board shall notify this Department when a license is granted and that the Department shall have jurisdiction to determine that the sources of water supply and works for the disposition of sewage are sanitary.

To assist local boards of health in adopting rules and regulations to carry out the provisions of this act, this Division prepared suggested rules and regulations which were sent upon request to the boards. The Department has been notified of the adoption of rules and regulations by 92 local boards of health during the year.

This Division, in accordance with the act, has examined the water supply and sewage disposal at 634 licensed camps in 166 municipalities during the year. The following summary shows the results of the examinations:

Camp Examinations—1940

	Overnight Camps	*Recreational Camps*
Both water supply and sewage disposal satisfactory	235	63
Both water supply and sewage disposal unsatisfactory	5	7
Water supply unsatisfactory	42	9
Sewage disposal unsatisfactory	10	2
Improvements recommended on both water supply and sewage disposal	35	29
Improvements recommended on water supply	63	25
Improvements recommended on sewage disposal	76	33
Total camps examined	466	168

Water Supplies at Civilian Conservation Corps Camps

The number of bacterial examinations made of samples of water submitted from Civilian Conservation Corps Camps throughout the State are shown in the following table:

C. C. C. Camps—1940

Station No.	Company No.	City or Town	Reservation—(R) State Forest—(S.F.)	No. of Samples Examined
11035	2103	Agawam	Robinson Park (R)	10
4103	1181	Andover	Harold Parker (S.F.)	12
11076	120	Athol	Petersham (S.F.)	8
2154	2141	Becket	October Mountain (S.F.)	3
11030	1115	Brewster	Nickerson Park (R.)	13
2147	173	Brimfield	Brimfield (S.F.)	11
2149	113	Chester	Chester-Blandford (S.F.)	8
11041	1199	Douglas	Douglas (S.F.)	6
2153	108	Great Barrington	Beartown (S.F.)	9
11050	1159	Greenfield	–	3
11029	1173	Holyoke	Mount Tom (R)	11
11039	1105	Lenox	October Mountain (S.F.)	10
11066	2105	Salisbury	Salisbury Beach (R)	12
11028	1149	Saugus	Breakheart (R.)	12
11032	1171	Savoy	Savoy Mountain (S.F.)	14
2160	1174	Spencer	Spencer (S.F.)	5
11038	1139	Townsend	Willard Brook (S.F.)	6
11042	1153	Warwick	Warwick (S.F.)	10
11072	127	Warwick	Warwick (S.F.)	13
11051	1174	Westfield	–	10
2198	107	Williamstown	Mount Greylock (R.)	7
2144	167	Winchendon	Otter River (S.F.)	

Federal Projects

During the past year considerable time has been devoted to the general supervision of Pollution Project W. P. 18120 of the Federal Work Projects Administration, relative to the pollution of streams. This project was sponsored by the Department under the provisions of Chapter 22 of the Resolves of 1939. The consideration of proposed projects of the Federal Work Projects Administration in municipalities of the Commonwealth has entailed considerable work by the Division, 139 such projects having been approved or considered by the Department during 1940.

These projects are summarized in the following table:

Summary of Federal Projects Considered by Massachusetts Department of Public Health in 1940

Description of Project	*Number*
Water Supply	
Treatment plants	2
Improvements to treatment plants	1
Improvements to sources	5
Extensions and improvements of distribution systems	1
Total	9
Sewerage	
Improvements to treatment works	1
Intercepting sewers	6
Extension of sewers	120
Total	127
Municipal Buildings	
School sewerage	1
Infirmary sewage disposal improvements	1
Total	2
Flood Control	
Retaining walls	1
Total	139

Of the 127 W.P.A. sewerage projects above referred to action was taken in the following municipalities:

Adams	Sanitary sewers
Agawam	Connecticut River intercepting sewer
Andover	Sanitary sewers
Arlington	Sanitary sewer
Attleboro	Sanitary sewers
Belchertown	Sanitary sewerage system
Beverly	Sanitary sewers
Brockton	Sanitary sewers and storm water drains
Brockton	Improvement of sewage disposal works
Brookline	Sanitary sewers and storm water drains
Cambridge	Sanitary sewers and storm water drains
Canton	Sanitary sewers
Chelsea	Sanitary sewers
Chicopee	Intercepting sewer
Dartmouth	Sanitary and storm water sewers
Dedham	Sanitary sewers
East Longmeadow	Sanitary sewers
Fall River	Sanitary sewers
Fitchburg	Sanitary sewers and storm water drains
Framingham	Sanitary sewers
Gloucester	Sanitary sewers
Gosnold	Repairs to sewerage system
Greenfield	Sanitary sewers
Haverhill	Sanitary sewers
Holyoke	Combined sewer
Lawrence	Sanitary sewers and storm water drains
Leominster	Sanitary sewers and storm water drains
Lexington	Sanitary sewers
Longmeadow	Sanitary sewer
Lowell	Sanitary sewers
Lowell	Inverted siphon under Concord River
Lynn	Sanitary sewers
Malden	Sanitary sewers
Marblehead	Sanitary sewers
Marion	Improvement of sewage filter beds proposed W. P. A. Project
Maynard	Sanitary sewer
Milford	Sanitary sewers
Natick	Sanitary sewer

New Bedford	Sanitary sewers and storm water drains
Newburyport	Sanitary sewers
Newton	Sanitary sewers
Northampton	Sanitary sewer outfall to Connecticut River
North Adams	Sanitary sewers
North Andover	Sanitary sewers
North Attleborough	Sanitary sewers
Norwood	Sanitary sewers
Pittsfield	Sanitary sewers
Russell	Sanitary sewers
Salem	Sanitary sewer
Saugus	Sanitary sewers
Somerville	Sanitary sewers and storm water drains
South Hadley	Sanitary sewers
Springfield	Sanitary sewers, combined sewer and relief sewer
Stockbridge	Improvement of sewage treatment works
Stoneham	Sanitary sewers
Walpole	Sanitary sewers
Ware	Intercepting sewer
Watertown	Sanitary sewers
Webster	Reconstruction of sewage disposal works at Town Infirmary
Wellesley	Sanitary sewer
West Springfield	Sanitary sewers
Woburn	Sanitary sewers
Worcester	Combined sewers and storm water drains

Engineering Work at State Institutions

This division has prepared plans and inspected construction work in connection with water supplies, sewage disposal and other matters at various State institutions, as shown in the following table:

Danvers State Hospital

Installation of a chlorinator for treatment of institution water supply.
Study for the construction of a water supply system.

Gardner State Hospital

Investigation for additional wells.

Grafton State Hospital

Inspection of construction of additional sewage filters.

Monson State Hospital

Inspection of construction of additions to water supply system and sewage disposal works.

Lakeville, Pondville, North Reading, Westfield and Rutland State Sanatoria and Forest Hills Laboratory

Studies of the physical condition of interior water piping and study for additional water supply at North Reading State Sanatorium.

Lakeville State Sanatorium

Installation of corrective treatment for the water supply.

Bathing Places

The following table shows the results of examinations of bathing places during the year 1940:

City or Town	*Bathing Place*	*Remarks*
Abington	American Legion Pool	Water not inferior to that at other popular outdoor bathing places. Elimination of source of pollution recommended.
Agawam	Pond in Robinson State Park	Water suitable for public bathing. Chlorination recommended on low flows.
Andover	Proposed swimming pool in Harold Parker State Forest	Water suitable for public bathing — daily flow measurements recommended.
Arlington	Spy Pond and Arlington Heights Reservoir	Waters not inferior to those found at other public bathing places. Suitable bathing facilities recommended at Spy Pond.
Barnstable	Garrett's Pond	Water suitable for public bathing although containing a considerable growth of microscopic organisms.
Braintree	Weymouth Fore River at Watson Park	Not advisable to encourage public bathing at this location.

City or Town	*Bathing Place*	*Remarks*
Braintree	Sunset Lake	Water suitable for public bathing. Sanitary facilities recommended.
Cambridge	Swimming pool at Radcliffe College	Water suitable for public bathing.
Canton	Bolivar Pond and Mansfield Pond	Bolivar Pond preferable for development of bathing beach.
Canton	Proposed swimming pool	Site not suitable for public bathing.
Chelmsford	Crystal Lake	Water suitable for public bathing. Recommended that bathing be confined to portion of Lake where bathing facilities are provided.
Chelsea	Swimming pool at Y. M. C. A.	Water suitable for public bathing. More adequate chlorination recommended.
Chester	Swimming pool at Camp Brookside Lodge	Water suitable for public bathing. Chlorination recommended during period of low flow.
Concord	Bateman's Pond	Water suitable for public bathing.
Dudley	Stevens High Pond	Water suitable for public bathing. Suitable sanitary facilities recommended.
East Longmeadow	Redstone Lake	Water not inferior to that found at many other public bathing places. Suitable sanitary facilities recommended.
Framingham	Learned Pond	Water suitable for public bathing. Bathhouse and toilet facilities recommended.
Gill	Swimming pool at Mt. Herman School	Adequate chlorination and removal of cross connections recommended.
Haverhill	Swimming pool at Bradford Junior College	Water suitable for public bathing. Adequate chlorination and removal of direct connection to sewer recommended.
Hingham	Hingham Bathing Beach	Water suitable for public bathing.
Hingham	Hingham Yacht Club	Unsuitable site for public bathing.
Hingham	Kimballs, Wompatuck and Downor Avenue beaches	Water suitable for public bathing.
Hingham	Swimming pool at Hingham Ammunition Depot	Wells supplying water of excellent quality for bathing.
Holyoke	Wading pool at Community Field	Adequate chlorination and suitable sanitary facilities recommended.
Longmeadow	Cooley Brook	Chlorination recommended. Addition of water from public water supply during periods of low flow recommended.
Lynn	Lynn Beach	Water of excellent quality for public bathing.
Marshfield	Chandler's Pond	Water of suitable quality for public bathing.
Medfield	Kingsbury Pond	Water suitable for public bathing. Bathing should not be encouraged unless water is suitably chlorinated.
Medford	Upper Mystic Lake	Water not inferior to that at other popular outdoor bathing places.
Medford	Mystic River at West Medford and Fosters Court beaches	Water not suitable for bathing at time of examination (June 27)
Medford	Wrights Pond	Water suitable for public bathing. More adequate sanitary facilities recommended.
Medford	Fosters Court Beach	Water suitable for public bathing (Aug. 6).
Medway	Existing and proposed bathing sites for children	Pool at Legion Park suitable for public bathing. Charles River at West Medway not suitable for public bathing.
Melrose	Ell Pond	Water suitable for public bathing.
Middleborough	Municipal Swimming Pool	More adequate chlorination recommended.
Milford	Cedar Swamp Pond	Water suitable for public bathing. Sanitary facilities recommended.
Millis	Proposed bathing site Boggastowe Brook	Water suitable for public bathing. Bathhouses and sanitary facilities recommended.
Newton	Upper Falls Playground, Auburndale Playground and Allison Park beaches	Allison Park Beach unsuitable for public bathing. Note: No comment made on other two sites. Analyses sent to the Board of Health.
North Adams	Windsor Lake	Water not inferior to that found in many other public bathing places. Removal of sources of pollution recommended.
North Andover	Berry and Stearns Ponds	Water suitable for public bathing. Enlargement of sewage disposal facilities recommended.
Norfolk	Highland Lake	Unsuitable site for public bathing because of physical conditions and exposure to pollution.
Northborough	Bartletts Pond	Water not inferior to that at most popular outdoor bathing places although containing a considerable number of microscopic organisms.
Norwood	New Pond	Water suitable for public bathing. Bathhouse and sanitary facilities recommended.
Pelham	Bathing pool on watershed of Amethyst Brook	Violation of Rules and Regulations. Pool should not be used until suitable treatment works have been constructed.
Richmond	Richmond Pond	Water suitable for public bathing.
Russell	Worondake Lake	Water suitable for public bathing. Sanitary facilities recommended.
Somerville	Mystic River at Somerville Beach	Not more seriously polluted than numerous other popular salt water bathing places. Prevention of bathing recommended during and following any considerable rainfall because of overflowing sewage.
Uxbridge	Pout Pond Ironstone Reservoir Rivulet Reservoir	Waters suitable for public bathing. Proper sanitary facilities recommended.

City or Town	*Bathing Place*	*Remarks*
Ware	Swimming pool near Muddy Brook	Water suitable for public bathing after chlorination. Adequate chlorination recommended.
Washington	Felton Lake	Water suitable for public bathing. Bathhouses and sanitary facilities recommended.
Watertown	Pleasant Street Beach	Water contained larger number of bacteria characteristic of pollution than should be present if water is used for public bathing.
Wayland	Dudley Pond	Water suitable for public bathing although containing excessive growths of microscopic organisms and weeds.
Wayland	Baldwin Pond	Water satisfactory for public bathing although containing a considerable growth of microscopic organisms.
Westfield	Pond Brook	Water not inferior to that at many other public bathing places. Supervision and proper sanitary facilities recommended.
West Newbury	Swimming pool at Home of Angel Guardian	Water compared favorably with water used in similar pools. Safe for bathing.
Weymouth	Great Hill Beach	Water suitable for public bathing.
Winchester	Leonard Field Wedge Pond at Palmer Beach	Water of satisfactory quality for public bathing.
Worcester	Coes Reservoir Pool at Crompton Park	Water suitable for public bathing.

Activities in Connection with National Defense

During the latter part of the year considerable time of the Division was devoted to matters pertaining to National Defense. The Department conferred with and advised the consulting engineers engaged in the construction of additional sources of water supply and sewerage works at Camp Edwards and Fort Devens. Data relative to the adequacy of water supplies, sewerage works and other sanitation facilities in municipalities near military reservations and in industrial centers where plants are engaged on National Defense orders has been compiled for the U. S. Public Health Service.

The Division has conducted environmental sanitation surveys in the areas within two miles of the boundaries of Camp Edwards and Fort Devens. A similar survey will also be conducted in the vicinity of Westover Field in Chicopee, and a W.P.A. project proposal has been prepared with a view to enlarging the areas to be examined in the vicinity of these military reservations. In connection with the Camp Edwards survey, over 1,700 sites were examined and samples of water were analyzed from private sources of water supply. Data available from these surveys is used as a guide to the local health officials in correcting objectionable sanitary conditions.

At the request of the Adjutant General and the War Department, maps and statistical data relative to public water supplies and sewerage works in the State have been prepared for their information. In view of the formulation of Emergency Programs in matters of National Defense, the Department has advised all water works officials of the necessity of maintaining adequate supervision of water supplies and appurtenant works, the installation of auxiliary power sources where necessary and the establishment of emergency or auxiliary connections with water supplies in adjoining municipalities.

Water and Sewage Laboratories

During the year 1940 the work of the Water and Sewage Laboratories was chiefly analytical in connection with public and private water supplies, water purification plants, sewerage and problems of sewage disposal including the treatment of sewage and disposal of industrial wastes in connection with the pollution of streams. In addition, a very considerable amount of special work was carried out. The analytical work necessitated the analysis of 7,230 chemical samples and 2,208 microscopical examinations. Some of the special work was as follows:

The dosages of lime or soda ash and the optimum pH for corrosive correction treatment were determined for the following water supplies:

Water Supply of	Optimum pH	Dosages of Lime (Parts per Million)	Dosages of Soda Ash (Parts per Million)
Billerica (Middlesex House of Correction)	8.2	25	–
	8.4	–	46.5
Groton	8.2	16	–
	8.3	–	25
Hamilton	8.5	19	–
	8.8	–	51
Medfield	8.4	17.5	–
	–	–	–
Norfolk (Pondville Hospital)	8.6	11	–
	8.9	–	28.5
North Reading (State Sanatorium)	8.5	18	–
	8.7	–	37
Rutland (State Sanatorium)	9.1	7	–
	9.4	–	19
Sharon	8.5	19.5	–
	8.4	–	32.5
Stoughton	9.0	15	–
	10.0	–	70
Uxbridge	8.4	23	–
	8.7	–	50

Three commercial compounds, sold as inhibitors to prevent corrosion, were analyzed. One was found to consist of an aqueous solution of sodium silicate; a second was composed of a slightly alkaline solution containing gum tragacanth plus a trace of organic amines; and the third consisted of a slightly acid, aqueous solution of gums, sugar, a trace of benzoic acid and a volatile, resinous substance.

Experiments, similar to those carried out in 1939 on the effect of storage of water in asbestos-cement pipe, were conducted during the whole twelve months of 1940, using another brand of pipe. During this period the total dissolved solids content of the stored water decreased from 147 parts per million to 47 parts per million as compared with an average of 40 parts per million in the water used. The free caustic alkalinity disappeared after 27 days and the pH changed from 10.5 at the start of the experiment to 8.5 at the end of the year. During the same time, the soap hardness decreased from 80 to 21 parts per million.

In this connection, studies were made on the odor imparted to water stored in coated asbestos-cement pipe, using both unchlorinated and chlorinated water. These experiments were carried out by immersing a 10-inch section of 6-inch coated asbestos-cement pipe in a Pyrex glass jar containing the water. After 24 hours' storage, the water was removed and the pipe immersed in a fresh sample of water. This process was repeated daily for 5 weeks. Using one brand of coated asbestos-cement pipe, it was found that a faintly tarry odor was imparted to the water for 2 weeks. This odor changed to a faintly unpleasant odor for a week and thereafter changed to a vegetable and sweetish odor for the remainder of the experiment. The other brand of coated asbestos-cement pipe imparted a very faintly unpleasant odor to the water for 3 weeks and thereafter the odor was faintly sweetish for the remainder of the experiment.

Using water carrying a residual of 0.5 of a part per million free chlorine in a similar experiment, it was found that in one case the odor was faintly tarry and chlorinous for one week and thereafter was chlorinous. In the other case, the odor was faintly chlorinous and sweetish for the first week and thereafter was chlorinous. In neither case was there any evidence of the medicinal odors which result from the reaction of free chlorine with certain tarry substances.

Another experiment was performed on the effect of fairly strong mineral acid on uncoated and coated asbestos-cement pipe. The experiment was carried out by immersing sections of the pipe in Pyrex glass jars holding the acidified water. One brand of asbestos-cement pipe was immersed in a solution of hydrochloric acid, 1.0 per cent by volume, the water being changed every 24 hours. The total dissolved solids varied from 7,320 parts per million the first day to 6,810 parts per million on the eighth day. In the case of the other brand, the total dissolved solids varied from 6,020 parts per million on the first day to 7,550 parts per million on the eighth day. In the case of both pipes, there was evidence of marked disintegration for a depth of about one millimeter, due to the storage in 1.0 per cent hydrochloric acid for 8 days.

A similar experiment, using tar-coated asbestos-cement pipe in 5 per cent hydrochloric acid, gave with one brand of pipe a variation of total dissolved solids from 3,550 parts per million the first day to 4,200 parts per million the eighth day. With the other brand the dissolved solids varied from 370 parts per million the first day to 204 parts per million the eighth day.

The effect of the storage of water containing small amounts of free chlorine in lead pipe was studied over a period of 2 years. The experiment consisted in immersing 4-inch sections of 1-inch lead pipe in half-gallon jars holding a surface water to which free chlorine had been added. The water used was the Metropolitan supply having an average pH of 6.7, a free carbon dioxide content of 3.0 parts per million, an alkalinity of 10 parts per million, and a dissolved solids content of 46 parts per million. The samples were allowed to stand immersed usually for 24 hours, the chlorine dosage being checked once or twice during that time. At the end of 24 hours the water was changed and a fresh sample of water added. At the start of the experiment, when the surfaces of the pipes were clean, the amount of lead dissolved was quite large.

The following table summarizes the results obtained by storage of water containing various amounts of free chlorine in new lead pipe for one day, 7 days and 14 days:

(Parts per Million)

Concentration of Free Chlorine	Lead Content after		
	1 Day	7 Days	14 Days
.0	1.5	4	13
.1	1.6	13	16
.3	1.6	20	32
.5	1.6	42	70

As the experiments progressed and the pipes acquired a protective coating, the amounts of lead dissolved became lower.

The following table summarizes four daily results of 24 hours' storage in 4 concentrations of free chlorine in water after the pipes had been in use almost 2 years:

(Parts per Million)

Concentration of Free Chlorine	Lead Content after 24 Hours' Storage
.0	.53
.1	.80
.3	.80
.5	1.6
.0	.33
.1	.33
.3	.67
.5	.67
.0	.60
.1	.80
.3	.93
.5	1.1
.0	.40
.1	–
.3	.67
5	.60

Several sets of experiments were run with the pipes in contact with chlorinated water for 7 hours. The following table shows the results of 3 of them:

(Parts per Million)

Concentration of Free Chlorine	Lead Content after 7 Hours' Storage
.0	.20
.1	.29
.3	.43
.5	.72
.0	.06
.1	–
.3	.27
.5	.53
.0	.17
.1	.17
.3	.40
.5	.40

It is evident from these laboratory experiments that there is a slight action of free chlorine in solution on bare lead pipe. However, while free chlorine in low concentration will react with metallic lead, it will not react with lead salts, such as lead sulphate or basic carbonate which are the chief constituents of the protective coating. Therefore, as the protective coating increases, the solvent action of free chlorine in solution decreases. In the case of lead service pipes that have been in use for a number of years, the increase in solvent action due to the presence of free chlorine in the water would be extremely slight and apparent only if the protective coating were deficient for some reason.

Samples of various colored crayons, 11 in number, were analyzed for their lead content. Of these, 4 that were yellow, green or orange in color, were found to have a lead content of from 0.25 per cent by weight to 3.9 per cent by weight or from 3 to 43 milligrams of lead per inch of crayon.

An analysis of a deposit taken from a water pipe at the Lakeville State Sanatorium proved it to be putty. A large, white deposit taken from a sewer pipe below a chemical company in one of the towns was found on analysis to consist largely of calcium carbonate, animal and vegetable fats and mineral oils. A brownish, incrustant material, taken from the inside of a hot water heater consisted chiefly of the corrosion products of iron and brass. A slight, white deposit, present on the inside of a 6-inch water main, was found to consist chiefly of zinc salts.

A whitish sediment obtained from a sample of melted ice was found to consist chiefly of calcium carbonate. Investigation of a complaint concerning the presence of a transparent, flaky, iridescent sediment in the water at a commercial establishment in one of our towns led to the conclusion that this sediment was the result of the flaking off of fine particles of glass from the inside of a badly etched glass container used to prepare hot drinks.

The examination of a number of samples of sand from the shores of one of our harbors showed the presence of mineral and other oils in some of the samples. Tests for the presence of mineral oil in scum floating on the surface of a shellfish tank were negative. Two samples of tarry substances found floating on streams within the State were found to consist of high-boiling hydrocarbon tar or pitch. Of 4 samples of scum collected from the surface of a lake, 2 that were collected near a dye works showed the presence of a low-boiling, inflammable mineral oil.

Three samples of sewage, each having a distinct odor of gasoline, on analysis gave no weighable amount of gasoline.

Mineral analyses were made of the public water supplies of Bridgewater and Chicopee, and of 2 sources of supply at the McLean Hospital, Belmont.

Experiments to determine the cause of the sudden increase in the mineral content of the water supply of the McLean Hospital, Belmont, showed that it was not due to the burning of peat bogs in the immediate vicinity of these wells but rather to a lowering of the ground water table, thus resulting in a draft from a wider area.

Deodorization of a trade waste and of a domestic sewage by free chlorine was studied. One sample, collected near an outlet tank at an industrial plant, required from 15 to 25 parts per million to mask the odor. In the other case, a sewage required from 10 to 15 parts per million of free chlorine to render the odor of the sample unobjectionable.

The failure of a section of brass pipe from one of our institutions was found to be due to extensive corrosion of the inside surface, resulting in a weakening of the structure of the pipe.

A red water trouble at the Lakeville State Sanatorium was investigated. From tests made in the laboratory it was decided that treatment of the water supply with 9.5 parts per million of hydrated lime, raising the pH to 9.6, would help correct this condition.

Field experiments were made using copper sulphate and sodium arsenite to exterminate the plant Lemna from the surface of a reservoir. It was found that copper sulphate up to 25 parts per million was entirely ineffective. Laboratory experiments using sodium arsenite showed that as little as 1.0 part per million of As_2O_3 was effective in killing all of this plant growth in 12 days.

A rare form of a fresh water organism, identified as Medusa-Craspedacusta, appeared in considerable numbers in the water supply reservoir of one of our municipalities. The organism resembled the marine type commonly known as jellyfish and when extended had a total diameter of from ½ to ¾ of an inch. This occurred in the latter part of August and the growth was so extensive that it was considered advisable to shut off this source of supply.

Experiments to eliminate this growth were begun, using copper sulphate and free chlorine. Dosages of copper sulphate from 0.1 of a part to 5.0 parts per million and a free chlorine dosage of 0.1 of a part per million were tried on specimens of Craspedacusta in jars supplied with water from the reservoir in question. It was found that dosages of copper sulphate as low as 0.4 of a part per million would kill this organism in 24 hours and 1.0 part per million in about 4 hours. A free chlorine dosage of 0.1 of a part per million appeared entirely ineffective.

The reservoir in question was treated with 0.3 of a part per million of copper sulphate and no specimens of Craspedacusta were observed for 4 days thereafter. Then a small number were again observed and it was decided to treat the reservoir with 1.0 part per million of copper sulphate after first removing the fish present.

The following table gives a summary of the analytical work carried on in the Water and Sewage Laboratories of this Division during the year 1940:

Samples from public water supplies:	
Surface waters	1,513
Ground waters	1,139
Special samples:	
Surface waters	305
Ground waters	1,894
Samples from rivers	1,158
Samples from sewerage systems and sewage disposal works	827
Samples of wastes and effluents from factories	39
Miscellaneous samples (partial analyses)	355
Microscopical examinations	2,208

Lawrence Experiment Station

Regular Work of the Experiment Station

The personnel of the Lawrence Experiment Station has exercised the same close supervision of the Newburyport shellfish purification plant as last year. This was necessary as the work of the Division made it impracticable to carry out complete supervision by the engineers. In connection with the semimonthly visits to this plant by the Experiment Station personnel, frequent analyses were made of samples of treated and untreated clams. The laboratory technique was checked from time to time as was also the technique of the laboratory at the Scituate plant until its close.

It was necessary for a representative of the Lawrence Experiment Station to go into court twice in connection with a civil suit relating to a public water supply. A chemist from the Lawrence Experiment Station also exercised supervision over various laboratories in the State engaged in the treatment of water or sewage with a view to coordinating the work and technique of these laboratories with that of the Lawrence Experiment Station so far as practicable. This oversight required 28 visits to 10 different laboratories. The personnel of the Station also made a number of investigations of public and private water supplies, which relieved the work of the engineering staff.

Two small subsurface irrigation installations for the disposal of septic tank effluents in 2 types of very fine soil were operated at the Experiment Station. The pipes are laid in trenches one foot wide. The installation in the finer soil disposed of an average of 2.12 gallons for each square foot of trench bottom and the coarser soil disposed of 2.57 gallons per square foot, somewhat smaller volumes than last year. Figures obtained from the operation of a roadside restaurant septic tank showed that about 0.87 of a gallon of effluent per square foot of soil was disposed of. This was probably not the maximum that could have been handled.

Two high rate trickling filters, one of crushed stone and the other of perforated tile, were operated at a rate of 25 million gallons per acre daily. A considerable reduction in B.O.D. was obtained but the relative stability of the effluent was only about 11 per cent. For the last 8 months of the year, part of the effluents of these 2 filters was recirculated. The volume of the recirculated effluent was 3 times that of the applied raw sewage, making the total rate of the filters 100 million gallons per acre daily. Recirculation increased the B.O.D. reduction but increased the relative stability only slightly.

Three identical septic tanks have been so operated that the theoretical detention of sewage in them has been 12 hours, 2 days and 6 days, respectively. The purpose is to determine over a considerable length of time which is the more efficient in destruction of sludge and clarification of the applied sewage.

Some extensive experiments were carried out on different methods of clarifying Boston sewage from the Nut Island outfall.

Extensive tests were carried out on the removal of iron, manganese and hardness from the water supply of the McLean Hospital in Belmont.

Shorter experiments were carried out on iron removal from the water supply of the North Reading State Sanatorium.

Experiments were carried out on the treatment of wastes from the grinding room of the American Optical Company at Southbridge.

It was found that distilled water contained traces of free chlorine when distilled from a continuous still using a municipal water supply carrying a small residual chlorine.

During the year visitors to the Lawrence Experiment Station included classes from the Lowell Textile School, Harvard University, Worcester Polytechnic Institute, Massachusetts Institute of Technology, Thayer School of Civil Engineering, Tufts College, Lawrence General Hospital and Lynn Hospital.

Work Under the Federal Social Security Act

Two small rapid sand filter units were operated during the year to study the bacterial efficiency of a rapid filter operated without coagulants and the efficiency of a similar filter with a mat of aluminum hydroxide on its surface. As was to be expected, the filter without coagulant had a low efficiency. The mat of aluminum hydroxide was without effect.

The making of complete confirmations of all positive fermentation tests on all public water supply samples was carried out under the Federal Social Security Act.

The analytical work carried on at the Lawrence Experiment Station is summarized in the following table and a resumé of some of the research is submitted in the following pages:

Chemical samples from investigation of disposal of domestic sewage, filtration of water, and various rivers	2,157
Chemical samples from the investigation of trade wastes	211
Sand samples	290
Chemical samples in connection with the work under the Federal Social Security Act	44
Bacterial samples in connection with the regular work of the Department	18,151
Bacterial shellfish samples	842
Bacterial samples in connection with work under Federal Social Security Act	552

Bacterial Examination of Shellfish

In testing shellfish for pollution the score is based on the coliform bacteria present, as determined by the completed tests. In this work completed tests were made on 2,782 cultures, of which 553, or 19.9 per cent, were found to be not coliform. In addition, for comparison with certain other states, and in connection with research work, the coliform bacteria have been further differentiated into Escherichia, Aerobacter, and intermediates. A total of 2,229 such cultures were differentiated; of these 1,220, or 54.7 per cent, were Escherichia coli; 399, or 17.9 per cent, were intermediates; and 610, or 27.4 per cent, were Aerobacter.

Determinations of coliform bacteria in shellfish have been made at the Lawrence Experiment Station for at least 40 years.

In the 1930 report a brief summary was given of methods used and experiments and studies made up to that time. Following is a summary of this work from that time to date.

In 1931, 1,250 samples were examined. Comparisons were made on bacterial scores of clams shucked in a laboratory with ordinary cleanliness and commercially shucked stock. It was found that with ordinary care the score of shucked clams need not be materially higher than that of the unshucked. This is contrary to what is found with much commercially shucked stock and indicates what observations of some shucking plants have shown, that greater cleanliness is necessary in these plants.

In 1932, 1,085 samples were examined. It was noted that quahogs always had lower scores than soft clams from the same area and laboratory experiments demonstrated that quahogs have power to remove coliform bacteria from polluted sea water without showing a corresponding increase in coliform bacteria in their shell water.

In 1933, 927 samples were examined. In further work on quahogs it was found that quahogs near sewer outfalls became only slightly contaminated as compared to soft clams. This was true in shell-water tests as well as when the whole body of the quahog was ground up and tested.

In 1934, 523 samples were examined. Quahogs planted near sewer outlets in Newburyport were successfully treated in the Newburyport clam plant.

In 1935, 622 samples were examined. From this year on, the personnel of the Experiment Station has exercised supervision of the technique of laboratories at shellfish purification plants. Studies were made of the bacterial content of scallop meats and the effect of various methods of cooking them. Scallop meats prepared for market under clean conditions contain practically no coliform bacteria.

In 1936, 531 samples were examined. No special work was done.

In 1937, 475 samples were examined. Determinations of streptococci were made on some samples. Extensive comparisons between the Standard Methods and the Eijkman method of bacterial examinations were made. The results indicate the advisability of retaining present Standard Methods.

Experiments indicate that mussels can be purified by the same methods as soft clams.

In 1938, 786 samples were examined. A large amount of work was done in differentiating the coliform bacteria found in shellfish in connection with a proposal to use Escherichia coli as the sole index of pollution.

In 1939, 799 samples were examined. This year, completed tests were made on all coliform bacteria isolated from shellfish. Differentiation tests were also carried out on most of the samples.

Bacterial Examination of Water

Differentiation studies on coliform bacteria from Merrimack River water stored 30 days and then filtered through sand showed in the process of purification a slight but definite decrease in the proportion of Escherichia and a corresponding increase in the proportion of Aerobacter, while intermediates were practically unchanged.

Special bacterial studies during the year included investigation of many media designed to eliminate contaminants from cultures of coliform bacteria. Several of these media, used singly or in succession, gave fairly satisfactory results but the work in general confirmed our belief that any discriminatory medium tends to kill weak coliform strains.

Many solid media have been suggested for the purpose of showing coliform bacteria direct without preliminary growth in broth. A special brilliant green agar, typical of such media, used on several hundred samples, gave results too high on water of good quality and too low on polluted waters. In fact, the agreement with such media was not as good as with litmus lactose agar which has been used over 40 years at the Experiment Station as a rough indicator of pollution.

It has been the regular practice at the Lawrence Experiment Station to carry on all differentiation work at 37° C. During the year reports have been investigated in the literature that the use of a temperature of 30° C. gave a higher proportion of Escherichia and a lower proportion of intermediates. A total of 341 cultures was examined at 37° C. and at 30° C. In no case did a culture which gave intermediate reactions at 37° C. show the reactions of Escherichia at 30° C. and the net number of intermediates was practically the same at both temperatures. In view of these findings, it was concluded that we were not justified in changing our incubator temperature.

Character of the Sewage Used at Lawrence Experiment Station

The sewage used for experimental purposes at the Lawrence Experiment Station is pumped from the Osgood Street sewer of the city of Lawrence on the opposite side of the Merrimack River through about 1,850 feet of 3-inch pipe. The pump is of the centrifugal type and is capable of pumping 65 gallons a minute. In the following tables the term "regular sewage" refers to this sewage.

On July 1, 1938, a 5,000-gallon concrete underground storage tank for sewage was put in operation. The centrifugal pump discharges into this tank and a smaller automatic pump fills an elevated 1,200-gallon tank which supplies sewage to all the filters at the Station. The term "settled sewage" in this report refers to the sewage from this 1,200-gallon tank. There is no accumulation of sludge in the large tank because the intake of the small pump is at the bottom and the discharge from the large pump stirs up the contents. The outlet of the 1,200-gallon tank to the filters is at such a height that a space for 200 gallons is left for sludge. When 500 gallons have been run out of the 1,200-gallon tank the automatic pump starts up and refills the tank. Sludge is drawn once a week in winter and more frequently in warmer weather and is applied to Imhoff Tank No. 545. In spite of the intermittent filling, there is considerable settling in the tank.

Imhoff Tank

The Imhoff Tank, known at our Experiment Station as Tank No. 545, is made of concrete, 20 feet deep, with a settling compartment 7 feet, 4 inches long by one foot wide and has gas vents one foot square at each end. The bottom of the settling compartment has a slope of 45 degrees toward the center where there is a slot opening. The digestion compartment has a capacity of 357 gallons, while the settling compartment has a capacity of 715 gallons, giving a theoretical detention period of about 1¼ hours during the 2 hours a day that the sewage is being applied.

This tank is really a combination of Imhoff and separate digestion tank. It is operated as an Imhoff Tank 2 hours a day when sewage is passed through it. The addition of the sludge settled from the 1,200-gallon tank used to supply the various filters gives it the nature of a separate digestion tank. This sludge is added direct to the digestion compartment, this, with the sludge settling out of the sewage applied to the Imhoff Tank, was equal to 402 pounds of dry sludge. Two hundred and forty-nine pounds of well-digested sludge were drawn from the outlet during the year. The average composition of the digested sludge on the dry basis was: fats, 16.5 per cent; nitrogen, 4.08 per cent; volatile matter, 63.3 per cent. The average pH of the sewage as pumped was 6.9; after some time in the settling tank it was 6.7; and after passing through the Imhoff Tank, it was 6.9.

Average Analyses of Lawrence Sewage

(Parts per Million)

Ammonia: Free	Ammonia: Albuminoid: Total	Ammonia: Albuminoid: In Solution	Kjeldahl Nitrogen: Total	Kjeldahl Nitrogen: In Solution	Chlorides	Oxygen Consumed	B.O.D.	Fats	pH	Bacteria per Cubic Centimeter 4 Days-20° C.
1940										
Regular Sewage										
37.7	11.3	3.90	22	6.9	44	83	545	51	6.9	3,700,000
Settled Sewage										
40.9	7.57	3.20	15	5.9	46	52	436	46	6.7	2,070,000
Sewage after Passing through Imhoff Tank No. 545										
47.6	5.59	2.60	10	4.8	44	40	262	40	6.9	1,900,000
1936–1940, Inclusive										
Regular Sewage										
38.3	10.9	4.86	21	9.3	46	77	490	49	–	3,500,000
Settled Sewage										
36.8	7.57	3.90	14	7.2	44	53	386	35	–	2,800,000
Sewage after Passing through Imhoff Tank No. 545										
42.4	5.96	3.34	11	6.2	44	42	285	33	–	2,700,000

Average Suspended Solids

(Parts per Million)

	Total	Loss on Ignition	Fixed
1940			
Regular sewage	334	270	64
Settled sewage	169	141	28
Sewage after passing through Imhoff Tank No. 545	117	96	21
1936-1940, Inclusive			
Regular sewage	277	222	55
Settled sewage	153	127	26
Sewage after passing through Imhoff Tank No. 545	105	85	20

Septic Tanks

The 2 septic tanks which have been operated at the Experiment Station since June, 1920, are known as Tanks Nos. 507 and 508. Tank No. 507 is 4 feet long, 2 feet wide and 40 inches deep, with a sloping bottom and has a capacity of 185 gallons. Tank No. 508 contains 2 compartments each the same size as Tank No. 507 and has a capacity of 370 gallons. Sewage enters each tank through trapped inlets and discharges through a pipe reaching 15 inches below the surface of the sewage in the tank. A baffle, located ⅓ of the distance from the inlet to the outlet, reaches to within 8 inches of the bottom of the tank. Tank No. 507 receives practically fresh household sewage and Tank No. 508 receives Lawrence sewage which is comparatively stale. Both tanks are so operated that theoretically the sewage is held in each for 2 days; that is, the amount of sewage added daily is equal to ½ the capacity of the tanks, disregarding the effect of the accumulated sludge.

At the beginning of the year 2 more septic tanks, exact duplicates of Tank No. 508, were put in operation. The sludge in Tank No. 508 was evenly divided between the 3 tanks. They were so operated that the theoretical detention in No. 691 was ½ day; in No. 508, 2 days; and in No. 690, 6 days. Data on the results of operation are shown in a following table.

The per cent reduction in B.O.D., both total and in solution, was directly proportional to the length of time of detention in the tanks.

Unexpectedly, and possibly due to sampling errors, the tank with the shortest detention destroyed the greatest per cent of the deposited solids.

In the operation of these tanks, 4.5 cubic feet of tank space would be required in Tank No. 691, 18 cubic feet in tanks Nos. 507 and 508, and 54 cubic feet in Tank No. 690, for each person, assuming 65 gallons per capita daily.

Operation of Septic Tanks
Average Analyses

(Parts per Million)								pH	Bacteria per Cubic Centimeter 4 Days-20°C.
Ammonia			Kjeldahl Nitrogen		Chlorides	Oxygen Consumed	Fats		
Free	Albuminoid Total	Albuminoid In Solution	Total	In Solution					
1940									
Fresh Sewage Applied to Septic Tank No. 507									
70.2	21.9	8.25	42.	15.	50.	122.	166	6.9	4,710,000
Effluent from Septic Tank No. 507 (two-day detention)									
60.0	5.33	3.02	9.4	5.5	47	37	22	6.7	1,830,000
Per Cent Removal									
–	76.	63.	78.	63.	–	70	87	–	61
Sewage Applied to Septic Tanks Nos. 508, 690, and 691									
38.4	9.18	4.54	17.	8.1	45	62	51	6.4	3,050,000
Effluent from Septic Tank No. 691 (half-day detention)									
40.8	4.86	2.89	8.4	4.8	43	33	21	6.5	1,830,000
Per Cent Removal									
–	47.	36.	51.	41.	–	47.	59	–	40
Effluent from Septic Tank No. 508 (two-day detention)									
47.9	4.42	2.35	7.6	4.2	42	30.	24	6.5	2,150,000
Per Cent Removal									
–	52.	48.	55.	48.	–	52.	53.	–	30
Effluent from Septic Tank No. 690 (six day-detention)									
43.8	3.15	1.83	5.4	3.3	43	22	11	6.7	1,920,000
Per Cent Removal									
–	66.	60.	68.	59.	–	65	78	–	37

Operation of Septic Tanks — Concluded

Average Analyses

(Parts per Million)								pH	Bacteria per Cubic Centimeter 4 Days-20°C.
Ammonia			Kjeldahl Nitrogen		Chlorides	Oxygen Consumed	Fats		
Free	Albuminoid								
	Total	In Solution	Total	In Solution					
1936–1940, Inclusive									
Fresh Sewage Applied to Septic Tank No. 507									
104.	22.3	9.68	40.	18.	79	122.	120	–	3,242,000
Effluent from Septic Tank No. 507 (two-day detention)									
103.	8.29	5.28	15.	9.4	73	53	25	–	1,800,000
Per Cent Removal									
–	63.	45.	62.	48.	–	57	79	–	44
Sewage Applied to Septic Tanks Nos. 508, 690 and 691									
40.0	9.57	5.38	17.	9.8	46	56	55	–	2,600,000
Effluent from Septic Tank No. 508 (two-day detention)									
48.0	4.79	2.81	8.5	5.3	45	34	18	–	1,600,000
Per Cent Removal									
	50.	48.	50.	46.	–	39.	67.	–	38

Average Suspended Solids

(Parts per Million)

	Total	Loss on Ignition	Fixed
1940			
Fresh Sewage applied to Septic Tank No. 507	628	535	93
Effluent from Septic Tank No. 507	82	69	13
Per Cent Removal	87	87	86
Sewage applied to Septic Tanks Nos. 508, 690 and 691	234	193	41
Effluent from Septic Tank No. 691	72	61	11
Per Cent Removal	69	68	73
Effluent from Septic Tank No. 508	79	65	14
Per Cent Removal	66	66	66
Effluent from Septic Tank No. 690	46	38	8
Per Cent Removal	80	80	80
1936-1940, Inclusive			
Fresh sewage applied to Septic Tank No. 507	532	463	69
Effluent from Septic Tank No. 507	113	97	16
Per Cent Removal	79	79	77
Sewage applied to Septic Tanks Nos. 508, 690 and 691	222	181	41
Effluent from Septic Tank No. 508	83	65	18
Per Cent Removal	63	64	56

Septic Tanks — Data on Operation

	Tank No.			
	691	507	508	690
Days' storage	½	2	2	6
Lbs. sludge in tank, Jan. 1, 1940	18	36	18	18
Lbs. sludge deposited in tank 1940	232	88	61	25
Lbs. sludge in tank, Dec. 31, 1940	42	49	49	27
Per cent sludge destroyed	83	60	38	37
Sludge in Tanks				
Per cent loss on ignition—1st compartment	85	69	60	54
Per cent loss on ignition—2nd compartment	60	–	55	43
Per cent fats—1st compartment	14.2	16.8	9.9	12.1
Per cent fats—2nd compartment	14.8	–	16.4	18.6
Per cent nitrogen—1st compartment	3.16	4.41	3.08	3.32
Per cent nitrogen—2nd compartment	3.84	–	3.82	4.02
B.O.D. of applied sewage—unfiltered	460	707	460	460
B.O.D. of applied sewage—filtered	294	276	294	294
B.O.D. of effluent—unfiltered	305	183	250	184
B.O.D. of effluent—filtered	222	120	187	145
Per cent B.O.D. reduction in suspended matters	34	74	46	60
Per cent B.O.D. reduction in soluble matters	24	57	36	51

Activated Sludge

Experiments on the aeration of sewage have been carried on at the Lawrence Experiment Station continuously since 1911 and descriptions and results of this work have been published in the annual reports of the Department. Activated sludge Tank No. 485, which was started in 1917, is still in operation. It has 3 compartments in series, 75 inches deep, each holding 230 gallons. The overflow from the last compartment, comprising the treated sewage and considerable sludge, passes through 2 settling tanks with capacities of 600 and 160 gallons, respectively, allowing 3¾ hours sedimentation. During this time, the activated sludge settles out and is run to a storage tank where it is aerated, and at intervals of several hours is pumped back to the first compartment. The sewage is retained in the aerating compartments about 3½ hours. Air is applied at the bottom of each compartment through a filtros plate, clamped to the top of an iron box, at a rate of approximately 1.15 cubic feet of air per gallon of sewage treated. Excess sludge, equivalent to 445 pounds of dry material per million gallons of sewage treated, has been pumped to waste. This sludge contained, on a dry basis, 77 per cent volatile matter, 7.6 per cent nitrogen and 4.6 per cent fats.

The purification of sewage by this activated sludge tank has been on the whole somewhat lower than that of the various trickling filters at the Experiment Station.

The B. O. D. reduction has been as good as that of 4 of the trickling filters but the relative stability has been much lower than that of any of the trickling filters. This is due to the fact that the activated sludge effluent has had practically no nitrates while the filter effluents were well nitrified. Nitrates contain available oxygen which increases the relative stability.

Operation of Activated Sludge Tank No. 485
Average Analyses

(Parts per Million)

Color	Ammonia: Free	Ammonia: Albuminoid: Total	Ammonia: Albuminoid: In Solution	Kjeldahl Nitrogen: Total	Kjeldahl Nitrogen: In Solution	Chlorides	Nitrogen as—: Nitrates	Nitrogen as—: Nitrites	Oxygen Consumed	B.O.D.	Fats	Relative Stability	Bacteria per Cubic Centimeter 4 Days–20°C.
1940													
Settled Sewage Applied to Activated Sludge Tank No. 485													
–	40.9	7.57	3.20	15.	5.9	46	–	–	52	436	46	–	2,070,000
Effluent from Activated Sludge Tank No. 485													
74	33.5	4.88	2.64	8.5	4.9	44	.190	.067	26	66	–	43	400,000
Per Cent Removal													
–	–	36.	18.	43.	17.	–	–	–	50.	85.	–	–	81
1936–1940, Inclusive													
Settled Sewage Applied to Activated Sludge Tank No. 485													
–	36.8	7.57	3.90	14.	7.2	44	–	–	53	386	35	–	2,800,000
Effluent from Activated Sludge Tank No. 485													
74	29.4	3.71	2.38	6.6	4.3	45	1.23	.138	19	–	–	–	679,000
Per Cent Removal													
–	–	51.	39.	53.	40.	–	–	–	64.	–	–	–	76

Average Suspended Solids
(Parts per Million)

	Total	Loss on Ignition	Fixed
1940			
Settled Sewage applied to Activated Sludge Tank No. 485	169	141	28
Effluent from Activated Sludge Tank No. 485	60	50	10
Per cent removal	64	65	64
1936-1940, Inclusive			
Settled sewage applied to Activated Sludge Tank No. 485	153	127	26
Effluent from Activated Sludge Tank No. 485	52	41	11
Per cent removal	66	68	58

Trickling Filters

Since 1890 there have always been trickling filters in operation at the Lawrence Experiment Station for the study of various problems in connection with such filters. During the year 1940, twelve trickling filters were operated with sewage. These were grouped so as to include studies of the effect of different depths of crushed stone, different sizes of stone, the effect of different rates of operation and the effect of different preliminary treatments of the applied sewage. In addition, 4 small filters were operated for a few months in connection with studies on the purification of trades wastes.

All analyses of the effluents were made on samples that had been settled one hour. Solids were determined in the samples as collected and after one-hour settling.

The sewage applied to these filters during 1940 had a B. O. D. of 436 parts per million, about the same as last year.

Settled sewages applied to municipal trickling filters in Massachusetts have B. O. D.'s ranging from 60 to 255 parts per million, with an average of 144 parts per million. The sewage applied to the Experiment Station filters has a B. O. D. nearly twice as strong as the strongest and 3 times as strong as the average of the sewage applied to municipal trickling filters.

The stronger sewage places more load on the filters and tends to produce effluents of lower stability and higher B. O. D.

Filters of Different Depths

Filters Nos. 452, 453, 454 and 455 are 4, 6, 8 and 10 feet in depth and all are constructed of the same size crushed stone, ¾ to 1½ inches in diameter. The dosing rates are so adjusted that each receives the same volume of sewage per acre foot.

Filter No. 455 was heavily unloading at the time of collection of some of the samples, the same as last year. This unloading was in evidence in samples collected during 6 months of the year and made the quality of the effluent somewhat lower than normal. The suspended solids were slightly higher than the applied sewage.

The effluent of the 8 foot filter was the best with no great difference between the other 3.

Average Analyses

Effluents from Trickling Filters—Effect of Different Depths

Filter Number	Depth (Feet)	Size of Stone (Inches)	Quantity Applied — Million Gallons Daily per Acre Foot	(Parts per Million) Ammonia: Free	Ammonia: Albuminoid: Total	Ammonia: Albuminoid: In Solution	Kjeldahl Nitrogen	Nitrogen As— Nitrates	Nitrogen As— Nitrites	Oxygen Consumed	B.O.D. Unsettled	B.O.D. Settled	Relative Stability
					1940								
Settled Sewage	–	–	–	40.9	7.57	3.20	15.	–	–	52	436	–	–
452	4	¾–1½	.41	24.9	3.14	1.91	5.5	8.4	.48	19	104	72	77
					Per Cent Removal								
				39.	59.	40.	63.	–	–	63	78	83	–
453	6	¾–1½	.41	21.9	3.04	2.00	5.5	6.5	.36	19	101	77	76
					Per Cent Removal								
				416.	60.	38.	63.	–	–	63	77	82	–
454	8	¾–1½	.41	19.0	2.37	1.66	4.3	13.0	.31	14	72	42	90
					Per Cent Removal								
				55.	69.	48.	71.	–	–	73	83	90	–
455	10	¾–1½	.41	28.3	3.25	2.23	5.9	4.1	.32	18	113	69	67
					Per Cent Removal								
				31.	57.	30.	61.	–	–	65	74	84	–
					1936–1940, Inclusive								
Settled Sewage				36.8	7.57	3.90	14.	–	–	53	386	–	–
452	4	¾–1½		18.4	3.07	1.98	5.5	8.4	.33	18	69	–	76
					Per Cent Removal								
				50.	59.	49.	61.	–	–	66	82	–	–
453	6	¾–1½	.38	18.0	2.88	1.77	5.2	7.3	.25	17	50	–	87
					Per Cent Removal								
				51.	62.	55.	65	–	–	68	87	–	–
454	8	¾–1½	.40	16.2	2.61	1.58	4.7	13.7	.33	14	43	–	92
					Per Cent Removal								
				56.	66.	59.	69.	–	–	74	89	–	–
455	10	¾–1½	.41	21.9	3.12	2.14	5.7	8.7	.29	18	59	–	84
					Per Cent Removal								
–	–	–	–	41.	59.	45.	62.	–	–	66	85	–	–

Filters of Different Size of Material

Three filters, Nos. 135, 677 and 475, each with 10 feet of filtering material, were operated to show the effect of the size of the material. Filter No. 135 with the finest material had the best effluent; the effluent of the filter with the coarsest stone, No. 475, was nearly as good; and the filter with the intermediate size material had an effluent of only slightly poorer quality. This last filter did more unloading than the other two, at least in the 38 samples collected during the year.

Average Analyses

Effluents from Trickling Filters—Effect of Different Size Crushed Stone

Filter Number	Depth (Feet)	Size of Stone (Inches)	Quantity Applied — Million Gallons Daily per Acre Foot	(Parts per Million) Ammonia — Free	Ammonia — Albuminoid — Total	Ammonia — Albuminoid — In Solution	Kjeldahl Nitrogen	Nitrogen As— Nitrates	Nitrogen As— Nitrites	Oxygen Consumed	B.O.D. — Unsettled	B.O.D. — Settled	Relative Stability
					1940								
Settled Sewage	–	–	–	40.9	7.57	3.20	15.	–	–	52	436	–	–
135	10	⅜–1	.15	19.7	2.64	1.77	4.7	14.6	.32	17	73	48	88
Per Cent Removal				51.8	65.	45.	69.	–	–	67	83	89	–
677	10	¾–1½	.15	16.5	3.00	1.84	5.4	12.2	.41	17	101	61	79
Per Cent Removal				60.	60.	43.	64.	–	–	67	77	86	–
475	10	1½–2½	.15	15.6	2.84	1.90	5.1	9.9	.30	17	82	55	83
Per Cent Removal				62.	62.	41.	66.	–	–	67	81	87	–
					1936–1940, Inclusive								
Settled Sewage	–	–		36.8	7.57	3.90	14.	–	–	52	386	–	–
135	10	⅜–1	.15	15.4	2.54	1.77	4.6	16.5	.30	18	48	–	88
Per Cent Removal				58.	66.	55.	67.	–	–	65.	88.	–	–
677	10	¾–1½	.15	15.5	3.16	1.90	5.8	12.5	.39	23	94	–	81
Per Cent Removal				58.	58.	51.	59.	–	–	56.	76.	–	–
475	10	1½–2½	.15	15.1	3.21	2.04	5.8	10.7	.33	18	49	–	81
Per Cent Removal				59.	58.	48.	59.	–	–	65.	87.	–	–

Effect of Pretreatment

Filters Nos. 677, 572 and 573 were operated to study different forms of pretreatment of sewage applied to trickling filters. Filter No. 677 was operated as a control, with no pretreatment of the applied sewage. The sewage applied to Filter No. 572 received 3 grains of ferric chloride per gallon. The daily dose of sewage applied to Filter No. 573 was stored in a conical-bottom tank which discharged to the filter. A jet of air was blown through the sewage in this tank continuously, giving an average dissolved oxygen content of about 5.0 parts per million. Sludge was drained from this tank daily and there was no activated sludge effect.

Filter No. 573, receiving aerated sewage, had the highest B. O. D. reduction and nearly as high relative stability as Filter No. 572 which received ferric chloride. The effluent of Filter No. 677, the control, whose applied sewage received no preliminary treatment had the lowest relative stability.

In comparing the results of any of these series of filters, consideration should be given to the fact that the longer the period they are operated the better, because for no evident reason a filter may have periods of poor purification or of unusually good purification.

Average Analyses

Effluents from Trickling Filters.—Effect of Different Preliminary Treatments

Depth (Feet)	Size of Stone (Inches)	Quantity Applied — Million Gallons per Acre Daily	(Parts per Million) Ammonia — Free	Ammonia — Albuminoid — Total	Ammonia — Albuminoid — In Solution	Kjeldahl Nitrogen	Nitrogen As— Nitrates	Nitrogen As— Nitrites	Oxygen Consumed	B.O.D. Unsettled	B.O.D. Settled	Relative Stability
					1940							
					Settled Sewage							
–	–	–	40.9	7.57	3.20	15.	–	–	52	436	–	–
					Filter No. 677 (Control)							
10	¾–1½	1.5	16.5	3.00	1.84	5.4	12.2	.41	17	101	61	79
					Per Cent Removal							
			60.	60.	43.	64.	–	–	67.	77.	86.	–
					Filter No. 572 (settled sewage applied receives 3 g.p.g. ferric chloride)							
10	¾–1½	1.5	21.5	2.67	1.62	4.8	8.4	.34	16	114	55	86
					Per Cent Removal							
			47.	65.	49.	68.	–	–	69.	74.	87.	–
					Filter No. 573 (receives settled sewage aerated)							
10	¾–1½	1.5	15.1	2.98	1.85	5.4	13.7	.40	16	93	51	85
					Per Cent Removel							
			63.	61.	42.	64.	–	–	69.	79.	88.	–
					1936–1940, Inclusive							
					Settled Sewage							
–	–	–	36.8	7.57	3.90	14	–	–	52	386	–	–
					Filter No. 677 (control)							
10	¾–1½	1.5	15.5	3.16	1.90	5.8	12.5	.39	23	94	–	81
					Per Cent Removal							
			58.	58.	51.	59.	–	–	56.	76.	–	–
					Filter No. 572 (settled sewage applied receives 3 g. p. g. ferric chloride)							
10	¾–1½	1.5	18.0	2.33	1.51	4.3	12.9	.24	15	79	–	89
					Per Cent Removal							
			51.	69.	61.	69.	–	–	71.	80.	–	–
					Filter No. 573 (receives settled sewage aerated)							
10	¾–1½	1.5	13.8	3.14	1.91	5.6	14.6	.36	18	78	–	88
					Per Cent Removal							
			63.	59.	51.	60.	–	–	65.	80.	–	–

Trickling Filters Operated at Very High Rates

The primary object of operating filters at rates approximately 2 to 3 million gallons per acre daily is to get as much purification, nitrification and stability of effluents as possible. High rate filters operated at rates of approximately 25 million gallons per acre daily give only partially purified effluents of low stability. When the results are expressed in pounds reduction of B. O. D., the high rate filters make a much better showing than the low rate filters because they remove the B. O. D. most easily attacked from a large volume of sewage while the low rate filters take more completely the B. O. D. from a smaller volume of sewage.

Two trickling filters have been operated at high rates during the year. Filter No. 571 is 10 feet deep and is filled with crushed stone between 1½ and 2½ inches in diameter.

Filter No. 670 is 2 feet square, has a depth of 10 feet and is made up of perforated tile so placed that as far as possible the holes in the tile are in line for the whole depth. The holes are an inch in diameter and are separated by ½ inch of tile.

Sewage is applied to all trickling filters at the Lawrence Experiment Station by means of tipping basins discharging onto perforated plates. This seems to be the only practicable method of operation of such small filters. On the tile filter, a piece of crushed stone is placed over each hole to prevent sewage dropping directly through the filter.

About the first of May, provisions were made for recirculating part of the effluent of these 2 filters. Three volumes of effluent were pumped back to one volume of raw sewage applied, making the total rate of filtration 100 million gallons per acre daily. The effluents at this rate received 15 minutes' settling. The overflow from the settling tank went to a small tank in which was placed an automatic sump pump which discharged into a small storage tank above the filters. Another outlet from the bottom of each of the settling tanks was so adjusted as to waste an amount equal to the volume of raw sewage applied to the filter.

On sampling days, recirculation was stopped for several hours, and samples were then collected of the effluent with only raw sewage being applied. There may be objections that the operation of the filter for only a short time without recirculation would not be the same as if it were operated this way continuously. It is believed, however, that the samples as collected do give a fair comparison.

Recirculation gives some increase in purification but seemingly not enough to warrant the expense. In localities where good results have been reported with recirculation, the applied sewage has always been much weaker than the sewage applied to these filters. It is possible that recirculation is adapted only to weaker sewages or to rates lower than 25 million.

Average Analyses

Effluents from Trickling Filters. - Effect of Different Rates

Filter Number	Depth (Feet)	Size of Stone (Inches)	Quantity Applied: Million Gallons per Acre Daily	(Parts per Million) Ammonia: Free	Ammonia: Albuminoid: Total	Ammonia: Albuminoid: In Solution	Kjeldahl Nitrogen: Total	Kjeldahl Nitrogen: In Solution	Nitrogen As—: Nitrates	Nitrogen As—: Nitrites	Oxygen Consumed	B.O.D.: Unsettled	B.O.D.: Settled	Relative Stability
				1940										
Settled Sewage	–	–	–	40.9	7.57	3.20	15.	5.9	–	–	52	436	–	–
571	10	1½–2½	25.	38.7	4.77	2.69	9.0	4.8	.166	.06	28	258	213	14
				Per Cent Removal										
				5.	37.	16.	40.	19.	–	–	46	42	51	–
670	10	Perforated Tile*	25.	38.6	5.14	2.76	8.8	5.0	.425	.09	31	285	225	16
				Per Cent Removal										
				6.	32.	14.	41.	15.	–	–	40	35	48	–
455	10	¾–1½	4.1	28.3	3.25	2.23	5.9	–	4.13	.32	18	113	69	67
				Per Cent Removal										
				31.	57.	30.	61.	–	–	–	65	74	84	–
677	10	¾–1½	1.5	16.5	3.00	1.84	5.4	–	12.2	.41	17	101	61	79
				Per Cent Removal										
				60.	60.	43.	69.	–	–	–	67	77	86	–
				1936–1940, Inclusive										
Settled Sewage				36.8	7.57	3.9	14.	7.2	–	–	52	386	–	–
455	10	¾–1½	4.1	21.9	3.12	2.14	5.7	–	8.68	.29	18	59	–	84
				Per Cent Removal										
				41.	59.	45.	59.	–	–	–	65	85	–	–
677	10	¾–1½	1.5	15.5	3.16	1.90	5.8	–	12.5	.39	23	94	–	81
				Per Cent Removal										
				59.	58.	65.	59.	–	–	–	56	76	–	–

*1-inch diameter.

Average Analyses—8 Months
Effluents from Trickling Filters—Effect of Recirculation

Filter Number	Depth (Feet)	Size of Stone (Inches)	Quantity Applied Million Gallons per Acre Daily	(Parts per Million) Ammonia Free	Ammonia Albuminoid Total	Ammonia Albuminoid In Solution	Kjeldahl Nitrogen Total	Kjeldahl Nitrogen In Solution	Nitrogen As— Nitrates	Nitrogen As— Nitrites	Oxygen Consumed	B.O.D. Unsettled	B.O.D. Settled	Relative Stability
Settled Sewage	–	–	–	40.3	7.13	2.67	14.	4.9	–	–	48	417**	–	–
571	10	1½–2½	25	37.9	3.99	2.11	7.6	3.7	.170	.03	23	199	170	15
				Per Cent Removal										
				6.	44.	21.	46.	24.	–	–	52	52	59	–
571 Recirculated			100	34.0	4.41	1.94	8.1	3.6	.420	.13	24	166	132	23
				Per Cent Removal										
				16.	38.	27.	42.	26.	–	–	50	60	68	–
670	10	Perforated Tile*	25	37.2	4.60	2.27	8.6	4.2	.325	.06	28	265	216	17
				Per Cent Removal										
				8.	35.	15.	39.	14.	–	–	42	36	48	–
670 Recirculated			100	29.9	4.54	2.20	8.8	3.7	.345	.19	24	191	155	20
				Per Cent Removal										
				26.	36.	18.	37.	24	–	–	50	54	63	–

*1-inch diameter. **B.O.D. of mixture applied to No. 571, 174; and to No. 670, 249.

Average Suspended Solids
Effluents from Trickling Filters

Filter Number	Depth (Feet)	Size of Stone (Inches)	Rate of Operation Million Gallons per Acre Daily	Treatment	Unsettled Samples Total	Unsettled Samples Loss on Ignition	Unsettled Samples Fixed	Settled Samples Total	Settled Samples Loss on Ignition	Settled Samples Fixed
					(Parts per Million)					
1940					*1940*					
Settled Sewage	–	–	–	–	169	141	28	–	–	–
452	4	¾–1½	1.6	none	139	103	36	42	36	6
					–	–	–	75*	–	–
453	6	¾–1½	2.5	none	110	83	27	35	31	4
					–	–	–	79*	–	–
454	8	¾–1½	3.3	none	114	89	25	25	22	3
					–	–	–	85*	–	–
455	10	¾–1½	4.1	none	178	125	53	34	28	6
					–	–	–	80*	–	–
135	10	⅜–1	1.5	none	103	72	31	36	29	7
					–	–	–	79*	–	–
677	10	¾–1½	1.5	none	179	127	52	38	32	6
					–	–	–	78*	–	–
475	10	1½–2½	1.5	none	153	109	44	36	30	6
					–	–	–	79*	–	–
572	10	¾–1½	1.5	ferric chloride	248	165	83	41	31	10
					–	–	–	76*	–	–
573	10	¾–1½	1.5	3 gr./gal. aerated	235	163	72	40	34	6
					–	–	–	76*	–	–
571	10	1½–2½	25.	none	110	94	16	55	48	7
					–	–	–	67*	–	–
			100.	recirculated	152	124	28	63	54	9
					–	–	–	63*	–	–
670	10	perforated tile 1-inch perforations	25.	none	144	121	23	67	58	9
					–	–	–	60*	–	–
			100.	recirculated	145	122	23	65	56	9
					–	–	–	62*	–	–
1936–1940, Inclusive					*1936–1940, Inclusive*					
Settled Sewage	–	–	–	–	153	127	26	–	–	–
452	4	¾–1½	1.5	none	106	75	31	–	–	–
453	6	¾–1½	2.3	none	95	67	28	–	–	–
454	8	¾–1½	3.2	none	95	71	24	–	–	–
455	10	¾–1½	4.1	none	138	94	44	–	–	–
135	10	⅜–1	1.5	none	80	54	26	–	–	–
677	10	¾–1½	1.5	none	148	90	58	–	–	–
475	10	1½–2½	1.8	none	114	81	33	–	–	–
572	10	¾–1½	1.5	ferric chloride	155	94	61	–	–	–
573	10	¾–1½	1.5	3 gr/gal. aerated	191	126	65	–	–	–

*Per cent removal.

The Trickling Filter as a Decolloider

By decolloiding is meant the conversion of colloids to suspended solids that will settle out of sewage.

In connection with the disposal of sewage at Camp Edwards by leaching on sand areas, it is desirable to remove as much of the suspended solids and matters that will separate out in the upper layers of sand. To study this, a small filter with a depth of 4 feet of crushed stone from 1½ to 2½ inches in diameter has been operated at the Lawrence Experiment Station at a 10-million rate. Partially settled Lawrence sewage was applied.

The suspended solids of the applied sewage and of the effluent of the filter before and after one hour settling were determined. The results are shown in the following table:

Average of 92 Analyses

	Suspended solids (Parts per Million)	Per Cent Reduction
Unsettled applied sewage	190	–
Settled applied sewage	102	46
Unsettled effluent	142	–
Settled effluent	47	75

Operation of a Shallow Trickling Filter at a High Rate

Ammonia: Free	Ammonia: Albuminoid: Total	Ammonia: Albuminoid: In Solution	Kjeldahl Nitrogen: Total	Kjeldahl Nitrogen: In Solution	Nitrogen As—: Nitrates	Nitrogen As—: Nitrites	Chlorides	Oxygen Consumed	B.O.D.: Unsettled	B.O.D.: Settled	Relative Stability
					Settled Sewage						
42.3	7.35	2.92	14.	5.3	–	–	49	55	424	–	–
					Effluent from Shallow Trickling Filter No. 701 (Rate 10 m. g./a. d.)						
37.2	4.41	2.13	8.0	–	.242	.13	48	24	202	166	19
					Per Cent Removal						
12.	40.	27.	43.	–	–	–	–	56	52	61	–

(All columns: Parts per Million)

Refiltration of the Settled Effluent of a High Rate Trickling Filter

A somewhat similar combination of high rate trickling filter and sand filter occurs in the plans of the proposed sewage disposal works for Southbridge.

In this case, main reliance is placed on the trickling filter to reduce the B. O. D. sufficiently except during the warmer months of the year when it is proposed to pass as much as possible of the settled trickling filter effluent through existing sand filters at as high a rate as possible. To study such maximum possible rates, a sand filter has been operated at the Lawrence Experiment Station with the settled effluent of high rate Filter No. 670. The sand filter, No. 700, is 4 feet in depth of sand of an effective size of .48 millimeter. It was started June 10, 1940 and was dosed with the effluent of Filter No. 670 at a rate of 250,000 gallons per acre daily. On July 18, the rate was increased to 500,000 but because of clogging it was again reduced to 250,000 on September 16, at which time it was scraped. Because of the coarse sand and high rate of operation, the effluent of this filter has been rather turbid and contained some suspended solids. In spite of this, nitrification has been high and the effluent has been completely stable.

Average Chemical Analyses

Refiltration of High Rate Trickling Filter Effluent

(Parts per Million)

Suspended Solids			Ammonia			Kjeldahl Nitrogen		Nitrogen As—				
				Albuminoid								
Total	Loss on Ignition	Fixed	Free	Total	In Solution	Total	In Solution	Nitrates	Nitrites	Oxygen Consumed	B.O.D	Relative Stability
Settled Effluent from High Rate Trickling Filter No. 670 Applied to Sand Filter No. 700												
100	85	15	30.0	5.00	2.20	8.4	3.7	.350	.20	22	173	20
Effluent from Sand Filter No. 700												
30	20	10	5.81	1.86	–	–	–	30.6	.23	11	47	99

Disposal of Sewage by Subsurface Irrigation

Where disposal of sewage through septic tanks is necessary because of lack of sewers, it is frequently advisable to dispose of the effluent of the septic tanks by subsurface irrigation. It should be pointed out here, that contrary to the belief of many persons, the passage of sewage through a septic tank does not constitute adequate purification. The effluent of a septic tank is potentially as dangerous as raw sewage. The main purpose of the septic tank is to dispose of part of the solid materials settling out in the tank by converting them to gas or liquid.

In subsurface irrigation, the liquid is disposed of into the ground through subsurface lines of Akron or tile pipe laid with open joints and surrounded by coarse material such as crushed stone, a sufficient area being allowed for the liquid to leach away. It is obvious that the volume of sewage that can be disposed of in this way through a given length of pipe depends on the porosity of the soil. To obtain data in this regard, 2 small installations were made at the Lawrence Experiment Station in each of which 4-inch Akron pipe was laid in a trench one foot wide. The joints were laid open and covered with tarred paper and the trenches were filled to just over the top of the pipe with coarse cinders in the first installation and crushed stone in the second. Over this were placed successive layers an inch thick of graded pebbles and sand, and then the trench was filled with excavated material. Each pipe line was 8 feet long with 2 side lines at the middle, each 2 feet long, giving an effective trench area of 14 square feet. The 3 open ends were loosely closed with brick and the fourth by means of an elbow was brought above the surface of the ground for the reception of the mixed effluents of Septic Tanks Nos. 507 and 508, which are relatively free from suspended matter.

The first installation, No. 686, was started in August, 1938. The soil at the bottom of the trench, 2 feet from the surface, had an effective size of 0.034 millimeter and a uniformity coefficient of 5.4. At a depth of 2 feet below this, the effective size was 0.02 millimeter and the uniformity coefficient, 11.8. The second installation, No. 688, was started November 1, 1938. The bottom of this trench was 6 feet below the surface and was in river silt with an effective size of 0.041 millimeter and a uniformity coefficient of 2.9. Both of these units are favorably situated with respect to ground-water level. There can be effective leaching only when the ground-water level is somewhat below the bottom of the trench.

The method of operating the units was to pump the effluent from the septic tanks each morning into the vertical section of pipe until the horizontal pipe was full. More sewage was applied around noon, if necessary, and the pipe was filled again at night. Probably there were times during the night when the pipe and trench were empty of sewage.

Amount of Sewage Disposed of by Subsurface Irrigation
(Average Gallons per day per square foot of Trench Area)

Month	Unit No. 686—Sand of 0.034 mm.	Unit No. 688—Sand of 0.041 mm.
January	2.07	5.93
February	1.43	1.38
March	1.43	1.43
April	1.02	1.28
May	1.33	1.32
June	1.48	1.47
July	3.01	3.57
August	3.43	3.48
September	3.22	3.22
October	3.35	3.35
November	1.76	2.86
December	1.59	1.93
Average	2.12	2.57

In addition to these installations, it has been possible to obtain data on the subsurface disposal of sewage at a roadside restaurant. Here the installation includes a septic tank discharging into about 250 feet of trench, 2 feet wide, containing 4-inch tile laid with open joints in crushed stone. This system disposes of domestic sewage and has been in operation for about 4 years. The soil in the bottom of the trench has an effective size of 0.030 millimeter and a uniformity coefficient of 13.0. Another similar trench, 423 feet long, takes care of the kitchen wastes and has been in use 2 years. The soil in this latter trench has an effective size of 0.032 millimeter and a uniformity coefficient of 14.5. This restaurant used 56,800 cubic feet of water during the year. It is impossible to apportion the amounts handled by each trench but on the average each square foot of trench has been disposing of about .87 gallon per day or slightly less than last year. There has been no evidence of waste flowing from the end of either line. There is no way of knowing the maximum amount that this installation could handle.

Biochemical Oxygen Demand of Merrimack River Water

The 5-day B. O. D. and dissolved oxygen of the Merrimack River water were determined once a month from June to November, inclusive, at the same stations as last year.

The B. O. D. at all stations except the 2 below Haverhill was higher than in 1939, the average being 8 per cent higher. The 1939 values were higher than those of 1938.

The dissolved oxygen was higher in 1940 in all except the 2 lower stations.

The high dissolved oxygen above Haverhill is caused by the passage of the water through rapids.

Average Analyses of Merrimack River Water

Station	B.O.D. (Parts per Million)	Dissolved Oxygen Per Cent of Saturation
	1940	
Below Nashua	2.1	87.4
At Tyngsborough	3.3	83.3
Above Lowell	3.9	79.2
Below Lowell	3.6	84.0
Above Lawrence	3.5	70.6
Below Lawrence	15.3	66.0
Above Haverhill	6.5	82.5
Below Haverhill	8.7	48.6
At Groveland	7.2	59.9
Above Amesbury	4.7	57.5
Above Newburyport	5.5	53.2
	1936–1940, Inclusive	
Below Nashua	1.7*	84.3*
At Tyngsborough	2.8	82.1
Above Lowell	3.0	81.9
Below Lowell	3.0	81.2
Above Lawrence	2.7	75.5
Below Lawrence	14.2	65.1
Above Haverhill	5.1	81.9
Below Haverhill	9.2**	44.2**
At Groveland	6.7	54.3
Above Amesbury	4.7	70.0
Above Newburyport	4.3	62.4

*Average for 4 years. **Average for 2 years.

Purification of Polluted Surface Water by Storage

The study of the effect of storage on the purification of water, begun in 1930, has been continued. There are used 2 covered concrete tanks, each 16 feet in diameter and with an effective depth of 3 feet, 9 inches. A small door in each tank allows diffused light to enter during the warmer months, but during the winter the doors are closed. The first tank is divided into 3 sectors, one of which has a capacity about as great as the combined capacity of the other 2. The second tank is divided into 4 equal sectors. All of these 7 sectors or compartments are connected in series, the inlet to each being at the bottom, and the outlet near the top. Merrimack River water is passed continuously into the first compartment at such a rate that the total detention period is 30 days. Probably because of the absence of direct sunlight, practically no color reduction results during the period of storage. In 1940 the average color of the applied water was 41 parts per million and that of the water after storage 37. For the past 10 years, the average colors have been 41 before storage and 39 after storage.

In 1940 the number of coliform bacteria in the applied water was reduced 99.35 per cent, and the 20° C. bacteria, 88.75 per cent.

The method of operating these tanks is to apply the river water through a valve controlled by a ball cock which maintains a constant water level in the tanks. The rate of flow is controlled at the outlet.

During the summer a leak developed in the bottom of the first and second compartments which represent about ¼ of the capacity of the 2 tanks. It was not detected until the leakage became greater than the capacity of the pipe supplying the river water. The effect of this was to reduce the storage period by a possible maximum of 7½ days over an uncertain length of time.

Storage as usual, however, this year removed practically all suspended matter and considerably reduced free, total and soluble albuminoid ammonia.

A sand filter, No. 577, was operated at a rate of 2,500,000 gallons per acre daily with the stored water, and a duplicate filter, No. 576, was operated with raw river water. Both filters contain 4 feet in depth of sand with an effective size of 0.25 millimeter. The filter receiving the stored water showed an efficiency in removing coliform bacteria somewhat higher than in past years but it was still much less efficient than the filter receiving raw water.

This is typical of the results obtained when water free from suspended matter is filtered through a slow sand filter.

Purification of Merrimack River Water by Storage and Filtration
Average Chemical Analyses
(Parts per Million)

	Color	Ammonia: Free	Ammonia: Albuminoid: Total	Ammonia: Albuminoid: In Solution	Chlorides	Nitrogen as — Nitrates	Nitrogen as — Nitrites	Oxygen Consumed	Hardness
1940									
Filter No. 576:									
Raw river water applied	41	.184	.266	.202	4.1	.126	.005	7.3	19
Effluent from	31	.120	.130	–	4.1	.285	.003	5.7	20
Per Cent Removal	24	35.	51.	–	–	–	–	22.	–
Filter No. 577:									
Stored river water applied	37	.180	.190	.163	4.5	.360	.006	5.9	31
Effluent from	31	.125	.138	–	4.5	.382	.002	5.1	31
Per Cent Removal	16	31.	27.	–	–	–	–	14.	–
1936–1940, Inclusive									
Filter No. 576:									
Raw river water applied	40	.145	.242	.183	3.8	.173	.006	6.3	15
Effluent from	25	.052	.110	–	3.8	.326	.001	4.8	16
Per Cent Removal	38	64.	55.	–	–	–	–	24.	–
Filter No. 577:									
Stored river water applied	38	.074	.168	.120	3.8	.302	.004	5.0	25
Effluent from	30	.040	.128	–	3.8	.356	.001	4.7	25
Per Cent Removal	13	46.	30.	–	–	–	–	6.	–

Purification of Merrimack River Water by Storage and Filtration
Average Results of Bacterial Examinations

	Bacteria per Cubic Centimeter: 4 Days 20°C.	24 Hrs.—37°C.: Total	24 Hrs.—37°C.: Red	Coliform Bacteria in 100 c.c.
1940				
River water before storage	10,300	740	160	6,300
River water after 30 days' storage	1,160	30	2	41
Per Cent Removal	89	96	99	99
Effluent from Filter No. 576	110	19	2	33
(Operated with raw river water)				
Total Per Cent Removal	99	97	99	99
Effluent from Filter No. 577	240	14	1	8
(Operated with stored river water)				
Total Per Cent Removal	98	98	99	99+
1936–1940, Inclusive				
River water before storage	10,840	908	144	6,220
River water after 30 days storage	645	40	3	66
Per Cent Removal	94	96	98	99
Effluent from Filter No. 576	189	23	4	47
(Operated with raw river water)				
Total Per Cent Removal	98	97	97	99
Effluent from Filter No. 577	327	19	1	25
(Operated with stored river water)				
Total Per Cent Removal	97	98	99	99+

Lawrence City Filters

For the past 47 years, the staff of the Lawrence Experiment Station has furnished general supervision, advice and analyses to the city of Lawrence in the operation of its water filters. Late in 1938 the city opened a water laboratory in connection with the operation of its rapid sand filters but the Lawrence Experiment Station still makes monthly chemical analyses, and bacterial examinations about 5 times each week, and also furnishes frequent advice and assistance in operation, especially regarding chlorination.

The water supply of Lawrence has been taken from the Merrimack River since 1875. Since 1893 the water has been filtered, and since 1918 the effluents have been chlorinated for greater safety. Up to 1938 the supply was furnished from 3 slow sand filters, — one of 2.2 acres built in 1893; one of 0.75 of an acre built in 1907; and a third, also 0.75 of an acre, built in 1926. The 2 newer filters and one section of the oldest are covered units. Late in 1938 a new rapid filter plant with a capacity of 8,000,000 gallons per day was placed in operation. As an added precaution the plans were approved with the understanding that the effluent of the rapid filter would be passed through the covered slow sand filters. The bottom of the covered unit of the oldest filter was found to be in such poor condition that it could not be used at all and as the newer covered slow sand filters could not always pass the volume of water required for the city it has been necessary from time to time to by-pass the slow sand filters and pump the effluent of the rapid filter directly to the distributing reservoir, after adequate chlorination. From June 3 to near the end of November, the West Open Filter was used in addition to the 2 covered filters to refilter the effluent of the rapid sand filters.

Before the rapid filters were placed in operation, it was necessary to apply about 1.5 parts per million of chlorine to the water in the pump-well to maintain a safe residual. Since the rapid filters have been in operation, the raw water in the mixing tank has been chlorinated, and postchlorination has been employed also, application being made either to the effluent of the rapid filters or to the combined effluent of the slow sand filters when they were in use. Final chlorination is made at the suction of the high lift pumps.

Prechlorination during the year was rather heavy. There was used 1.04 parts per million chlorine, based on the output of the plant and correcting for wash water. The prechlorination was very effective. One hundred and ninety-six samples were tested and the coliform index was 1.18. For postchlorination 0.41 of a part per million was used, making a total of 1.45 parts per million of chlorine used.

The effluent from the new rapid filters has been remarkably free of bacteria, the coliform bacteria having been reduced 99.9985 per cent before chlorination and 99.9999 per cent after chlorination. The reduction in the 4-day 20° C. count has been 99.71 per cent before chlorination and 99.90 per cent after chlorination. There has been evidence at times of slight aftergrowths in the storage reservoir. The effluents of the slow sand filters now receiving water from the rapid filters have shown very much better bacterial analyses than when receiving river water in past years.

Lawrence has had for many years an open storage reservoir, with a capacity of 41,500,000 gallons, which supplies the greater part of the city through the low service system. A high service system is supplied by water pumped from the city mains at a point near the pumping station. The reservoir had not been cleaned out since its construction until last year when the water level was brought down to the height of a wall which divides it into 2 equal sections.

Besides cleaning out a small amount of foreign matter, concrete bottoms were placed in both sections and the side walls were pointed up. The south section was out of service from before January 1 to August 10. Most of the work was done on the north section in 1939 but it was out of service for completion of the work from August 14 to December 10.

For about a week in August, many positive tests for coliform bacteria were found in the water in the reservoir. This condition is believed to have been due directly or indirectly to operations around the reservoir. Daily applications of a chlorine compound were made direct to the reservoir until this condition was overcome. The water pumped to the reservoir was entirely free from coliform bacteria. Potential danger did not seem to warrant the risk of overdosing and resulting complaints of tastes and odors.

The analyses of these few days are not included in the yearly average.

The average daily volume of water pumped during the year was 4,368,000 gallons.

Average Results of Bacterial Examinations of Water Collected in Connection with the Lawrence City Filters

Source of Sample	Bacteria per Cubic Centimeter			Per Cent of Bacteria Removed			Coliform Organisms in 100 c.c.
	4 Days 20°C.	24 Hrs.—37°C. Total	24 Hrs.—37°C. Red	4 Days 20°C.	24 Hrs.—37°C. Total	24 Hrs.—37°C. Red	
Raw Merrimack River water	12,300	1,470	330	–	–	–	9,000
Coagulated water at mixing tank, prechlorinated	46	17	1	99.6	98.8	99.7	1
Coagulated and settled water as applied to rapid sand filter	30	5	0	99.8	99.7	100.0	–[1]
Effluent from rapid sand filter	36	1	0	99.7	99.9	100.0	–[1]
West covered filter*	126	5	0	99.0	99.7	100.0	–[1]
All filters after postchlorination	12	3	0	99.9	99.8	100.0	–[1]
Outlet from distributing reservoir	85	5	0	99.3	99.7	100.0	–[1]
Tap at City Hall	63	6	1	99.5	99.6	99.7	–[1]
Tap at Experiment Station	51	7	0	99.6	99.5	100.0	–[1]
High service system	45	5	0	99.6	99.7	100.0	–[1]

*Secondary Filter, 8 months operation. [1]Less than 1.

Average Chemical Analyses of Water Collected throughout Year in Connection with the Lawrence City Filters

Source of Sample	Color	Ammonia Free	Ammonia Albuminoid	Chlorides	Nitrogen as Nitrates	Oxygen Consumed	Iron	Manganese	Hardness	pH
	(Parts per Million)									
Raw Merriamck River water	41	.206	.263	3.9	.103	7.4	.43	.07	10	6.5
Coagulated and settled water as applied to rapid sand filter	15	.213	.120	4.9	.141	3.3	.16	–	21	5.4
Per Cent Removal	63	–	54.	–	–	55.	63.	–	–	–
Effluent from rapid sand filter	7	.205	.095	4.9	.135	2.3	.07	.04	31	7.2
Per Cent Removal	83	–	64.	–	–	69.	84.	–	–	–
Effluent from west covered filter*	10	.046	.060	4.5	.214	1.7	.20	.04	29	6.7
Per Cent Removal	76	78.	77.	–	–	77.	53.	–	–	–
Outlet from distributing reservoir	11	.149	.100	5.5	.211	1.8	.14	.03	29	6.8
Tap at City Hall	12	.146	.091	5.6	.233	1.7	.19	–	30	6.8
Tap at Experiment Station	14	.140	.092	5.7	.242	1.7	.31	–	30	6.9

*Secondary Filter—8 months' operation.

Average Solids in Samples of Water Collected throughout Year in Connection with the Lawrence City Filters

(Parts per Million)

Source of Sample	Unfiltered Total	Unfiltered Loss on Ignition	Unfiltered Fixed	In Suspension Total	In Suspension Loss on Ignition	In Suspension Fixed
Raw Merrimack River water	74	28	46	12.9	3.5	9.4
Coagulated and settled water as applied to rapid sand filter	73	22	51	–	–	–
Effluent from rapid sand filter	77	22	55	–	–	–
Effluent from west covered filter*	73	21	52	–	–	–
Outlet from distributing reservoir	76	23	53	–	–	–
Tap at City Hall	74	21	53	–	–	–
Tap at Experiment Station	76	22	54	–	–	–

*Secondary Filter—8 months' operation.

Rapid Sand Filter Operation

Beginning in November, 1939, the rapid sand filters at the Experiment Station, No. 666 and No. 681, were operated with three objects in view. First, to determine the extent of purification obtained by filtering Merrimack River water through Filter No. 666 at a rate of 125 million gallons per acre daily without using a coagulant; second, to compare this effluent with that of Filter No. 681 which was similarly operated but had an artificial schmutzdecke of aluminum hydroxide formed on it before the beginning of each run; and third, the effect of refiltration of both of these effluents through slow sand Filters Nos. 667 and 668 at a rate of 5 million gallons per acre daily.

In order to obtain a representative supply of the effluent of the primary filters for secondary filtration, a portion of the effluent of each rapid sand filter was diverted to a galvanized iron tank in which was set an automatic sump pump. About every half hour the contents of the tanks were pumped to the tops of the slow filters. Effluent from No. 666 was pumped to the top of No. 668 and the effluent of No. 681 to No. 667. Whenever possible, the rapid sand filters were operated continuously. Delay in receiving pumping equipment made it impossible to start the secondary filters before May, 1940.

The amount of alum to produce a floc on the surface of Filter No. 681 was taken at the start as 1.15 grams per square foot of filter surface. This gave a mat having an approximate thickness of 0.003 of an inch. There being no noticeable effect on the filter effluent, the amount of alum was increased until the length of the runs began to decrease. This occurred when 11½ grams of alum per square foot of filter area was used. This gave a schmutzdecke about 0.03 of an inch in thickness but still there was no improvement in bacterial purification so the amount of alum was further increased until it reached the point where the amount of alum used was greater than the amount necessary in normal coagulation to completely decolorize and purify the amount of water filtered in this run. Four hundred grams of alum per square foot of filter area was used, giving a schmutzdecke one inch thick. Again there was no noticeable difference in bacterial removal. It was then decided to cut the amount to one-quarter of this in order to have a schmutzdecke one-quarter inch thick and at the same time to obtain fairly long runs. This amount was used continually from June through September. The aluminum hydroxide floc was formed by dissolving in the water on top of the filter the desired amount of alum and adding an equivalent amount of sodium carbonate solution.

For 10 months of operation, the effluent of rapid sand Filter No. 666 showed a 50 per cent reduction in the 4-day count, 87 per cent reduction in the coliform index, a 93 per cent reduction in suspended solids, a noticeable reduction in the free and albuminoid ammonia and nitrites, and an increase in the nitrates. The use of an artificial schmutzdecke gave results which did not differ materially from this.

For the 5 months of operation of the secondary filters, No. 667, which received effluent of the rapid filter with a blanket of aluminum hydroxide, gave a reduction in the 4-day count of 80 per cent, and a reduction of about 80 per cent in the coliform index. Filter No. 668, which received effluent of the rapid filter operated without coagulant, gave a reduction of about 88 per cent in the 4-day count and about 83 per cent in the coliform index. Both of these filters showed reductions of the free and albuminoid ammonia and nitrites and an increase of nitrates.

Both rapid filters, Nos. 666 and 681, showed a tendency in the later months toward greater reduction in the bacteria than in the earlier months. It is quite possible that the grains of sand in these filters were becoming coated with material beneficial to the reduction of bacteria, such as occurs in the ripening of slow sand filters.

The average results as a whole are practically alike for Filters Nos. 666 and 681 and indicate that there is no benefit whatsoever from the use of an artificial schmutzdecke of aluminum hydroxide.

The purification effected by the use of the rapid sand filter without coagulant was fairly good but of no practical use for water like that of the Merrimack River. It might be useful as a primary filter and in this capacity it would be beneficial to the slow sand filters because besides reducing the bacterial load, it filters out most of the sediment and reduces considerably the amount of scraping and washing of the sand in the slow filters. It was not necessary to scrape the secondary filters during the 10 months of operation. Basing the necessity for scraping on the content of suspended matter in the applied water, it appears that at least 90 per cent of the scraping and washing of the slow sand filters would be eliminated by the use of such a primary filter.

Average Chemical Analyses of Water Collected in Connection with the Operation of Rapid Sand Filters

(Parts per Million)

Color	Ammonia: Free	Ammonia: Albuminoid: Total	Ammonia: Albuminoid: In Solution	Chlorides	Nitrogen as Nitrates	Oxygen Consumed	Iron	Alkalinity	Hardness	pH
Raw River Water (applied to Filters Nos. 666 and 681)										
41	.184	.266	.202	4.1	.126	7.3	.37	9	19	6.5
Effluent from Rapid Sand Filter No. 666 (no coagulants)										
37	.227	.198	–	3.5	.168	5.7	.25	10	17	6.5
Effluent from Rapid Sand Filter No. 681 (blanket of A1 (OH_3 on surface of filter)										
38	.229	.211	–	3.3	.173	6.1	.27	10	18	6.5
Effluent from Secondary Filter No. 667 (effluent from Filter No. 666 applied)*										
31	.009	.126	–	3.5	.226	4.6	.21	10	16	6.5
Effluent from Secondary Filter No. 668 (effluent from Filter No. 661 applied)*										
30	.009	.120	–	3.3	.203	4.7	.21	10	15	6.5

*4 months' operation.

Average Suspended Solids in Samples of Water Collected in Connection with the Operation of Rapid Sand Filters

(Parts per Million)

Source of Sample	In Suspension: Total	In Suspension: Loss on Ignition	In Suspension: Fixed
Raw River Water	10.9	3.9	7.0
Effluent of Rapid Sand Filter No. 666	1.2	0.9	0.3
Effluent of Rapid Sand Filter No. 681	2.3	1.4	0.9

Average Results of Bacterial Examinations

Bacteria per Cubic Centimeter—4 Days, 20°C.

Filter No.	Jan.	Feb.	Mar.	May	June	July	Aug.	Sept.
				Raw Water				
–	16,700	14,700	13,500	5,800	18,700	9,100	6,000	4,100
				Effluent from Rapid Sand Filters				
666	8,800	6,700	10,100	1,600	7,000	6,600	1,050	350
681	9,000	5,700	8,200	1,600	4,800	5,100	2,400	890
				Effluent from Secondary Filters				
667	–	–	–	1,900	2,100	550	370	410
668	–	–	–	1,200	1,500	320	120	230

Organisms of Coliform Group in 100 Cubic Centimeters

Filter No.	Jan.	Feb.	Mar.	May	June	July	Aug.	Sept.
				Raw Water				
–	7,000	5,200	7,000	4,000	6,600	5,700	3,100	5,400
				Effluent from Rapid Sand Filters				
666	2,120	1,600	1,360	1,370	1,000	570	150	220
681	1,270	1,300	1,480	1,300	2,350	520	250	310
				Effluent from Secondary Filters				
667	–	–	–	180	550	270	140	200
668	–	–	–	75	700	150	84	160

Water and Sewage Laboratory at Westfield State Sanatorium

The laboratory work in connection with the oversight of inland waters in the westerly part of the State during the past year has been done in the Water and Sewage Laboratory of the Westfield State Sanatorium. This laboratory is financed entirely by the funds of the U. S. Public Health Service.

For the most part the samples analyzed were collected by the engineers of the Western District Office, together with samples of private water supplies collected by the personnel of the Berkshire Health District. The work in this laboratory included the bacterial, microscopical, chemical and physical examinations of water supplies and streams as well as biochemical oxygen demand determination of sewage and polluted water. The following numbers and types of samples were examined in this laboratory during the year 1940:

Number of bacterial examinations	1,766
Number of completions	1,505
Number of differentiations	797
Number of B.O.D. determinations	445
Number of chemical analyses	131
Number of physical examinations	290
Number of microscopical examinations	299

In addition to the above work, the following special analytical work was done in conjunction with the work of the engineering office:

The optimum pH for corrosive correction treatment, including the proper dosages of lime and soda ash, was determined for the following water supplies:

Water Supply of	Optimum pH	Dosages of Lime (Parts per Million)	Dosages of Soda Ash (Parts per Million)
Athol	8.8	24.5	–
Belchertown (State School)	8.7	20.	–
	8.9	–	70.
Chicopee	9.4	12.5	–
	9.5	–	40.
Ware	8.7	28.5	–
	8.9	–	83.
Westfield (State Sanatorium)	8.45	15.0	–
	8.5	–	40.0

A number of samples of sludge were also analyzed in the laboratory in conjunction with the starting of the digestion processes in the new sewage treatment plants in the western part of the State.

A model was set up in the laboratory to study the hydraulics of the proposed Agawam intercepting sewer which had in it the longest inverted siphon used in this State; and which was further complicated by the fact that there were two branches to the siphon and two pumping stations pumping into the siphon. The tests on this model resulted in some minor changes being made to the original engineering design.

The personnel of the laboratory supervised the operation of the swimming pool at the Westfield State Sanatorium.

Some work was done in the laboratory as to the effectiveness of an apparatus for the disinfection of water with chlorine and ozone.

A considerable amount of work was done in the laboratory using various media for the identification of the types of bacteria in water supplies, in order to determine if there were a media or combination of media that would eliminate unsatisfactory results in the examination of samples from certain unpolluted sources of supply. In this work the following selective media were used as differential plate media:

1. Brilliant Green Lactose Bile Agar
2. Methylene Blue Erythrosine Brom Cresol Purple Agar
3. Ferrocyanide Citrate Agar

These were run in parallel with the Standard Lactose Broth tests which were completed and differentiated with the use of Indol, Methyl Red, Voges-Proskauer, Citrate, and Cellobiose tests. Work was also carried out using Brilliant Green Lactose Bile Broth both as a primary and confirmatory media.

Due to the heavy seasonal load on the laboratory in the summer months, this work was not carried on during that period, and will therefore be continued during the coming year in order to obtain more complete data.

One water works superintendent spent considerable time in the laboratory learning the technique of making microscopical examinations of water, while an operator from one of the sewage treatment plants spent several days in the laboratory learning simple laboratory determinations in order to have better control of the operation of the treatment plant. In addition, a number of water department superintendents and members of boards of water commissioners visited the laboratory in order to obtain a more complete understanding of the work of the laboratory in relation to the bacterial quality of water.

REPORT OF THE DIVISION OF TUBERCULOSIS

Alton S. Pope, M.D., *Director*

I have the honor to submit the twenty-first annual report of the Division of Tuberculosis. This Division celebrates its twentieth birthday on December 1, 1940, having been created by an act of the Legislature in 1919, but not actually beginning to function until 1920. In the course of these twenty years great changes have occurred in the frequency and the method of management of tuberculosis. The death rate has declined 67 per cent, and the case rate proportionately; a particularly marked reduction has occurred in infancy, in such forms as miliary, meningeal and glandular tuberculosis, and among females. Sanatorium treatment has become firmly established as essential, and with it surgical measures for collapsing the diseased lung. It is twenty-one years since an X-ray machine was first installed at Rutland. More sensitive methods for the identification of tubercle bacilli have been devised. These are only a few of the many changes that have made both the practice of phthisiology and the public health control of tuberculosis totally different than they were when the division came into being.

Table 1. — Tuberculosis Deaths and Death Rates per 100,000
Massachusetts 1931–1940

Year	Pulmonary		Other Forms		Total	
	Deaths	Rate	Deaths	Rate	Deaths	Rate
1931	2,306	54.2	248	5.8	2,554	60.0
1932	2,041	47.9	260	6.1	2,301	54.0
1933	2,059	48.2	222	5.2	2,281	53.4
1934	1,902	44.5	214	5.0	2,116	49.5
1935	1,813	42.3	148	3.5	1,961	45.8
1936	1,733	40.4	165	3.8	1,898	44.2
1937	1,761	41.0	125	2.9	1,886	43.9
1938	1,536	35.7	139	3.2	1,675	38.9
1939	1,505	34.9	97	2.2	1,602	37.2
1940	1,475	34.2	122	2.8	1,597	37.0

It will be noted that these rates are slightly higher, especially in the later years, than those published in the last annual report. This is because up to 1939 it was necessary to use estimated population figures in computing rates, and the 1940 census has shown these estimates to have been too high. The rates presented above are based upon an arithmetic increase in population between the 1930 and 1940 Federal census.

State Sanatoria

The program of the State Sanatoria has gone on through the past year without changes. This year there has been no waiting list at Rutland, Westfield Tuberculosis Section or North Reading at any time, but Lakeville has intermittently had a waiting list of extrapulmonary tuberculosis and poliomyelitis cases. Pondville Hospital for cancer and the cancer section at Westfield, in spite of the rapid turnover of patients, have usually had a waiting list, often of considerable length. In November 1940 ten women from the Tewksbury State Hospital and Infirmary were transferred to Rutland State Sanatorium, enabling the Infirmary to close its ward for tuberculous women; hereafter no more women with tuberculosis will be accepted at the Infirmary. Most of these unsettled cases will go to Rutland, but some will go to county and municipal sanatoria. A table showing per capita cost and average census for the fiscal year in our institutions appears below. The differences in cost are due to the different types of cases treated. The cost is high at Pondville because of the large turnover of cancer cases, and the increased personnel needed, the number of special examinations and the frequency of radiation and of operative treatment. Westfield's per capita cost lies between the figures for the other sanatoria and Pondville because it includes both tuberculosis and cancer sections.

TABLE 2. — PER CAPITA COSTS

	Per Capita Costs per Week		Average Daily Census
	Gross	Net	
Rutland	$24.38	$18.60	282
North Reading	21.71	16.22	232
Lakeville	23.78	14.91	274
Westfield	38.42	26.18	213
Pondville	52.64	40.91	127

COUNTY AND MUNICIPAL SANATORIA

The most important changes in the county and municipal sanatoria are the completion of two new building projects. At the Sassaquin Sanatorium a new 72-bed building for patients has been constructed, and is now in use. At Cambridge, a new 39-bed wing has been placed in operation with modern X-ray and surgical facilities, and a reorganization of the medical staff. State subsidy has now been granted to the city of Cambridge for patients treated at this institution. Most of the county and municipal sanatoria report that their beds have been well filled, with patients awaiting admission at times. There have been no replacements among the superintendents of our own or the local sanatoria.

The study of the cost of tuberculosis in Massachusetts has been continued this year. The estimated daily average number of patients in all tuberculosis hospitals or departments in 1939 was 3,630, a slight decrease from the 3,707 in 1938. The estimated cost of care was $4,835,072, as compared with $4,725,568 in 1938. This does not include the amounts spent by local health departments other than for hospitalization. Obviously the way to reduce this heavy and continuing burden of expense is not by curtailing services, but by finding and treating tuberculosis earlier, thereby reducing the necessary period of hospitalization, exposing fewer persons to open tuberculosis, and lowering morbidity and mortality rates.

STATE SUBSIDY

In 1940 the sum of $494,745.54 was paid as subsidy to cities and towns in the Commonwealth which supported patients in approved county and municipal sanatoria. All but one of the public sanatoria in the State are now approved for subsidy.

RESEARCH STUDIES COMPLETED

The two research projects sponsored by the Commonwealth Fund were concluded during the year, the statistical study based on experience at the Tuberculosis Control Unit of Berkshire County, and the statistical studies of outpatient families and house cases at the Middlesex County Sanatorium which yielded valuable information in a period of slightly less than two years. The Middlesex study was also financed in part by the Commonwealth Fund, and it is planned to continue the collection and analysis of data with the aid of the codes and methods which have been devised.

At the end of the fiscal year, the Division of Tuberculosis is receiving aid from no outside agency except the Federal Government, which pays the salaries of a number of workers in the sanatoria and central office, and which also provides a certain amount of technical equipment, including X-ray films. Among the positions made possible through Federal grants is one clinic physician, whose principal duty is that of examining patients in the reclassification clinics.

ACTIVITIES OF THE CLINIC STAFF

The work of the clinic group falls under several headings. New school clinics were held during the school year 1939–1940 in 14 towns where 16,873 pupils, or 74 per cent of the enrollment of the selected high school grades, were tested with .01 mg. of old tuberculin. Of these, 5,195 or 31 per cent reacted to the test and were X-rayed. Six proved and suspicious cases of pulmonary tuberculosis were found. In the follow-up school clinic 1,981 pupils were re-examined and sanatorium treatment recommended for 17 cases of pulmonary tuberculosis. X-rays were taken of 490 children for the cities of Brookline, Fall River, and Worcester, with the discovery of one pulmonary case. In 9 teachers colleges, 2 dental schools, 1 medical school and 3 other collegiate institutions, 2,378 X-rays were taken and 14 pulmonary tuberculosis cases and suspects discovered. The X-ray films for this work were furnished by the schools.

A re-survey was made of inmates of the Walter E. Fernald State School who had been originally studied in 1930. A total of 1,023 inmates were tested with 2 dilutions of tuberculin, and X-rayed. A report on the findings is being prepared for publication.

With the aid of Federal funds, expended for the purchase of X-ray films, several X-ray surveys were carried out. A tabulation of the results appears in Table 3.

Table 3. — Incidence of Tuberculosis in Special Groups

Number X-rayed	2,304
Active pulmonary tuberculosis	8
Inactive pulmonary tuberculosis	16
Tuberculosis suspects	12
Per cent active pulmonary tuberculosis	0.35%

These surveys were conducted in the following groups: two Y. W. C. A. organizations, a shoe factory, and among slum dwellers of Boston and Cambridge, with the cooperation of the Boston and Cambridge Tuberculosis Associations. The highest incidence, 0.9 per cent active tuberculosis, was in the Boston slum group, who were residents of the South End and predominantly colored.

By and large, our surveys have yielded fewer cases of tuberculosis than comparable surveys in other places, particularly in New York City.

Reclassification clinics were held in 53 towns and cities on the request of their boards of health, in furtherance of the program begun in 1936. The total number of places where such clinics have now been held is 66. Immediately after a reclassification clinic the time is ripe to make any needed improvements in record keeping, case supervision or contact examinations. Such changes have been made in a number of towns at the suggestion of workers in the reclassification clinics. The consultant nurses of the Division of Child Hygiene and the district health officers have also interested themselves in improved local methods of tuberculosis control.

Arthritis Hospitalization

This was the third full year that the State has provided beds for arthritic patients at the Massachusetts General Hospital under the provisions of Chapter 393 of the Acts of 1937. It should be reiterated that the object of this program is primarily to add to our knowledge of arthritis, and to determine the feasibility of a hospitalization program, rather than to furnish care for any large number of indigent chronic arthritic patients. The average number of admissions per month was 9, and the average census for the year was 20. The average length of stay of patients discharged during the year was 68 days, and the total number of patient days on state beds was 7,379. Approximately 27 per cent of the cases treated are readmissions who have previously occupied a state bed.

Of the 108 discharges, 8 were of patients previously treated during the same year. This leaves 100 cases, whose diagnoses were as follows: Rheumatoid arthritis, 80; rheumatic fever, 2; gonorrheal arthritis, 3; and miscellaneous arthritic conditions, 15. In the rheumatoid arthritis group, 41 secondary diagnoses, many of them related to the primary disease, were made.

Altogether, 52 operative procedures were carried out; these included 13 biopsies, 13 joint aspirations and 11 vitalium cup arthroplasties (done on 7 patients). The results of treatment in the 100 patients discharged (again, in the case of re-entries, as of the final discharge) were: improved, 77; unchanged, 20; died, 3.

A number of meetings were held at the Massachusetts General Hospital by the arthritis group during the year. A statistical analysis of a series of cases of rheumatoid arthritis is being made for future publication.

Other Activities

The central office staff, in addition to their routine duties in connection with sanatorium administration, have made progress in several directions. The educational work has included publication of a new pamphlet on tuberculosis for general distribution, which health workers have found quite helpful; radio broadcasts; and participation in the programs of various meetings of nonprofessional and nursing groups. Approximately 53 talks have been given by our staff during the year.

In order to improve and encourage local tuberculosis case supervision and examination of contacts a set of records for the use of local boards of health has been developed. These include: a medical history and examination form; a family record; a time file card; and an index-and-classification card. These will be supplied to boards of health except in the larger cities on request. There has been considerable demand for them so far.

LAKEVILLE STATE SANATORIUM

LEON A. ALLEY, M.D., *Superintendent of Sanatorium*

Report of the Superintendent

To PAUL J. JAKMAUH, M.D., *Commissioner, Department of Public Health:*

I have the honor to submit the fourteenth annual report of the Lakeville State Sanatorium for the year ending November 30, 1940.

FINANCIAL STATEMENT

During the year there has been expended $339,120.54 for maintenance, a gross weekly per capita cost of $23.78. There has been collected from miscellaneous sources (the total of all collections) $126,427.13. Deducting this amount from the gross maintenance expenses leaves a net expense of $212,693.41 and a net weekly per capita cost of $14.91.

There has been collected from private sources $4,994.50; from cities and towns $119,833.12; and from sales $1,599.51.

There were 37 patients supported wholly or in part by private funds; 330 by cities and towns; 3 state wards, 76 wholly by state; and 74 on whom settlement has not been determined.

During the year there has been expended from Special Appropriations: Fire Protection and Sprinklers, $253.01; Sewage Disposal $78.40.

POPULATION

There were 284 patients in the sanatorium at the beginning of the year, December 1, 1939 (246 tuberculous and 38 poliomyelitis). There were 267 patients at the close of the year, November 30, 1940 (221 tuberculous and 46 poliomyelitis). The largest number present at any one time was 250 tuberculous patients and 54 poliomyelitis. The smallest number present at any one time was 211 tuberculous patients and 30 poliomyelitis. The daily average number of patients was 274.29 (233.63 tuberculous and 40.65 poliomyelitis). There were 238 patients admitted during the year (175 tuberculous and 63 poliomyelitis). For the classification of patients admitted your attention is called to Table 2. The average age of patients admitted was 27 years (tuberculous patients 31 years and poliomyelitis patients 17 years). Including deaths there were 255 patients discharged (200 tuberculous and 55 poliomyelitis). There were 16 deaths among the tuberculous patients. The average duration of residence was 439 days (tuberculous patients 497 days and poliomyelitis 231 days). There were 100,391 hospital days of treatment, 2,712 less than last year. (85,512 tuberculous hospital days of treatment and 14,879 poliomyelitis.)

The average number of employees and officers during the year was 209.748.

MEDICAL REPORT

While the patient population for the past fiscal year was quite stable, there were 12 fewer admissions than for the previous year and 10 more discharges. The drop in patient population occurred among the tuberculous patients, there being a drop in the average census of 7.26 over last year, while the infantiles declined only .92 from 1939. A review of the past four years, with the exception of 1939 which showed an increase of practically 4, shows there has been a steady decline in the number of patients admitted suffering from extrapulmonary tuberculosis.

There were 16 deaths during 1940, 7 less than in 1939. A review of the duration of residence of the deaths here shows the following: 1, 1 day; 1, 18 days; 1, 4 months; 6, 6 to 12 months; 3, 1 to 2 years; and 4 over 2 years.

While the general sanatorium treatment has been continued with but few changes, the surgical report shows a rather interesting change. The number of major operations performed among the tuberculous patients shows a drop from 75 to 59, while among the poliomyelitis patients there has been an increase from 43 to 74. This reveals a fair picture of the increase in the services rendered to the poliomyelitis cases admitted to Lakeville. The end results of the corrective surgery in this group have been of such an encouraging and gratifying nature that the construction of a treatment unit to improve facilities for the handling of these cases should show even more striking results in the future.

Outpatient examinations: new patients seen, 47; old cases, 213; number of visits, 260. Diagnoses made (new patients), negative for tuberculosis, 40; suspicious lesion, 1; extrapulmonary tuberculosis, 4; pulmonary tuberculosis, 2.

Contagious diseases were again at a minimum, there being one case of measles among employees; one case of measles among employees' children; and three cases of chicken pox among employees' children.

Institutional Activities

The following meetings were held at the institution during the year:

Plymouth District of the Massachusetts Medical Society.
Consultants for Clinics for Crippled Children.
Public Health Council.
Dairy Herd Improvement Association.
Andover Newton Theological School (Senior Class)
Harvard Medical School, Physiotherapy course (two meetings).
Truesdale Hospital Student Nurses (Orthopedic Class).

The occupational therapy department has continued to play a very active part in the treatment of both the extrapulmonary tuberculous and infantile paralysis patients. The early rehabilitation of the tuberculous individuals and the opportunity for muscle training and exercises under proper supervision for the infantiles cannot be overestimated. This department is handicapped by the limited personnel and, as in the previous Budget two years ago, we are again asking for the addition of one occupational therapist. This worker is needed in order that additional supervision and opportunities for supervised exercises may be available, thus shortening the period of hospitalization for many patients. Patients under treatment for the after effects of infantile paralysis require much more time and supervised exercises than do the convalescent extrapulmonary tuberculous patients and with but three workers the time is definitely limited in the majority of instances. Entertainment activities coming under the supervision of the occupational therapy department besides moving pictures have consisted of weenie roasts and weekly band concerts.

Farming activities have been continued as in previous years and the production of milk, fresh eggs, and vegetables in season has been a most valuable asset to the institution diet.

It is with the deepest regret that we report the sudden death, on March 16, of Dr. Z. B. Adams, orthopedic consultant here for 14 years and Dr. Peter Ferrini, assistant superintendent, August 5, following 6 years of service. The interest, time, and many other contributions of Dr. Z. B. Adams cannot be enumerated in a report of this kind. But to say that his whole heart and soul were in the work here would be but a small way of expressing what he meant to Lakeville. His loss, after so many years of faithful service is still keenly felt by all who knew him.

Dr. Ferrini, who was a member of the resident staff for 6 years and who always gave the best he had for the benefit of the patients and the sanatorium, died August 5, the first day of a well-earned vacation. His loss is keenly felt by the many patients and employees who knew him not only professionally but as an intimate associate.

The several changes of personnel among the resident and consulting staffs, as well as in the record and business offices, have resulted in disturbing conditions which have made it extremely difficult at times to keep up the many duties performed by the above-mentioned departments, which we trust will not continue during the ensuing year. There have been long delays in filling positions, especially those coming under the Department of Civil Service due to a scarcity of candidates who are willing to accept institutional employment. The salary rates among the office workers, especially those who are required to live outside of the institution, are so low that unless we can obtain individuals who can live at home somewhere in the vinicity of the institution, this problem may easily continue to be difficult to solve. Transportation facilities to surrounding towns have been curtailed so that it is impossible for individuals, not living in the vicinity, to commute to work here.

Improvements and Changes

One of the old boilers in the engine room which was in an unserviceable condition was replaced by a new 72-inch boiler early in the year.

Recommendations

The physiotherapy department shows a marked increase in the number of treatments to the infantiles but the crowded, cramped quarters continue to be a serious handicap. A treatment unit, for which funds have been requested in the Budget, would relieve this congestion and increase the efficiency of the department many fold.

A request has been made, in the Budget, for necessary funds for the construction of concrete ramps on the men's and women's wards for use as emergency fire exits. Present available exits on the above-mentioned wards are inadequate for the rapid removal of bed patients from those buildings.

Acknowledgments

For the many donations from interested friends, I wish to express the appreciation of the patients and personnel of the entire institution.

Your valued advice and confidence during the past year are gratefully acknowledged.

Respectfully submitted,

Leon A. Alley, M.D.,
Superintendent.

Surgical Report

The following operations were performed during the year:

*Tuberculous Patients**

Amputations	2	Nephrectomies	6
Appendectomies	3	Other kidney operations	2
Arthrodesis	24	Tonsillectomies	9
Biopsies	1	All other opreations	9
Exploratory laparotomies	1		
Incisions for drainage	2		59
		Cystoscopies	35
		Transfusions	15

*Of these operations, 15 were performed at the Baker Memorial Hospital in Boston.

Poliomyelitis Patients

Muscle transplants*	16	Tonsillectomies	4
Stabilizations*	25	All other operations	15
Stabilizations and muscle transplants	14		74
		Cystoscopies	2
		Transfusions	1

*Including other procedures such as plastics and tenotomies done at the same time.

Employees

Major abdominal operations	3
Tonsillectomies	1
All other operations	1
	5

Casts

The following types of plaster casts were applied during the year:

Boots	65	Shells	57
Buckets	2	Spicas	88
Cylinders	97	Splints	63
Jackets	189	Reinforcement	85
Moulds	27		673

Laboratory Report

Blood

1. Clinical Pathology

Red counts	705	Sedimentation tests	654
White counts	691	Hematocrit	4
Differential counts	636	Coagulation time	21
Hemoglobin	704	Bleeding time	19

2. Chemistry

Sugar	42	Nonprotein-nitrogen	168

3. Bacteriology and Serology

Blood culture	5	Blood for Wassermann and Hinton	461
Widal	52	Complement fixation for gonorrhea	6
Blood grouping	85	Agglutination test for undulant fever	5

Sputum

Smears	114	Cultures	77
Concentration	107	Guinea pig inoculations	54

Spinal Fluids

Cell counts	6	Cultures	2
Chemical	4	Inoculations	2

Urine

Routine chemical and microscopic	2,083	Kidney function test	57
Special chemical	3	Cultures	215
Inoculations	211	Tubercle bacilli smears	219

Feces

Occult blood	16	Bacteriological	
Ova, etc.	5	Cultures	20
		Smears	22
		Inoculations	8

Stomach Contents

Chemical	2	Bacteriological	
		Smears	16
		Cultures	13
		Inoculations	12

Pathology

Surgical specimens	29	Autopsies	15

Microscopic Sections

Paraffin	52	Pus inoculations	97
Pus smears	116	Nose, throat and mouth smears and cultures	414
Pus cultures	114		

Miscellaneous Examinations

Smears	75	Inoculations	73
Cultures	95	Bacteria-count for milk	21

Specimens Sent from Sanatorium to Central Laboratory

Cultures of feces and urine for typhoid	72	Spinal fluid for Wassermann	5
			8,704

X-rays

There were 3,207 x-rays taken during the year and 11 fluoroscopic examinations made.

Photographs

There were 709 photographs taken during the year and 16 mm. moving pictures were taken of 28 patients.

Physiotherapy

There were 9,099 physiotherapy treatments given during the year.

Dental Report

Examinations	477	Irrigations	171
Prophylactic treatments	513	Vincent's infection treatments	15
Fillings	843	Root canal treatments	14
Extractions	271	Oral surgical operations	21
Treatments	988		
Restorations	12		
Radiographs	127		
		General anesthesia	2
		Local anesthesia	283
		Nitrous oxide analgesia	14
Number of visits	2,069		
New patients	243		

School Report

Graded school work has been continued among the patients as in previous years

Table 1.—*Admissions and Discharges*

Tuberculosis Patients

	Adults		Children		Totals
	Males	Females	Males	Females	
Patients in the sanatorium Nov. 30, 1939	74	58	64	50	246
Patients admitted Dec. 1, 1939 to Nov. 30, 1940	72	53	26	24	175
Patients discharged Dec. 1, 1939 to Nov. 30, 1940	79	63	27	31	200
Patients remaining in sanatorium Nov. 30, 1940	68*	49*	62	42	221
Daily average number of patients	74.46	49.29	63.27	46.62	233.64
Deaths (included in number discharged)	10	4	1	1	16
*1 boy and 1 girl reached the age of 21 during the year and were shifted to adult columns.					

Poliomyelitis Patients

	Adults		Children		Totals
	Males	Females	Males	Females	
Patients in the sanatorium Nov. 30, 1939	2	1	15	20	38
Patients admitted Dec. 1, 1939 to Nov. 30, 1940	8	6	27	22	63
Patients discharged Dec. 1, 1939 to Nov. 30, 1940	6	4	23	22	55
Patients remaining in sanatorium Nov. 30, 1940	4	3	19	20	46
Daily average number of patients	3.05	2.85	15.84	18.91	40.65
Deaths (included in number discharged)	–	–	–	–	–

Total of Tuberculosis and Poliomyelitis Patients

	Adults		Children		Totals
	Males	Females	Males	Females	
Patients in the sanatorium Nov. 30, 1939	76	59	79	70	284
Patients admitted Dec. 1, 1939 to Nov. 30, 1940	80	59	53	46	238
Patients discharged Dec. 1, 1939 to Nov. 30, 1940	85	67	50	53	255
Patients remaining in sanatorium Nov. 30, 1940	72*	52*	81	62	267
Daily average number of patients	77.51	52.14	79.11	65.53	274.29
Deaths (included in number discharged)	10	4	1	1	16
*1 boy and 1 girl reached the age of 21 during the year and were shifted to adult columns.					

Table 2.—*Diagnosis and Classification on Admission*

Tuberculosis Patients

(Classification by Most Serious Lesion Present)

	Adults		Children		Total
	Males	Females	Males	Females	
Tuberculosis:					
Of intestines and peritoneum	4	9	3	2	18
Of the vertebral column	11	9	3	2	25
Of the bones and joints (vertebral column excepted)	16	10	2	5	33
Of the lymphatic system (bronchial, mesenteric and retroperitoneal glands excepted)	6	6	3	6	21
Of the genitourinary system	23	8	2	–	33
Of the skin and subcutaneous cellular tissue	3	2	1	1	7
Of other organs	2	3	5	1	11
Unclassified	2	4	–	2	8
Nontuberculous disease	5	2	7	5	19
	72	53	26	24	175

Poliomyelitis Patients

	Adults		Children		Total
	Males	Females	Males	Females	
Stage II	–	–	2	–	2
Stage III	1	1	1	1	4
Stage IV	6	5	24	20	55
Nonpoliomyelitis	1	–	–	1	2
	8	6	27	22	63

Table 3.—*Ages of Patients Admitted*

	Tuberculous Patients		Poliomyelitis Patients		Total of Tuberculous and Poliomyelitis Patients		
	Males	Females	Males	Females	Males	Females	Total
Under 5 years	2	3	–	–	2	3	5
5 to 9 years	5	7	4	3	9	10	19
10 to 14 years	7	7	7	9	14	16	30
15 to 19 years	9	5	16	10	25	15	40
20 to 29 years	26	17	5	4	31	21	52
30 to 39 years	16	20	2	–	18	20	38
40 to 49 years	18	7	1	2	19	9	28
50 to 59 years	5	8	–	–	5	8	13
60 to 69 years	7	1	–	–	7	1	8
70 and over	3	2	–	–	3	2	5
	98	77	35	28	133	105	238

Table 4. — *Source of Referral of Patients Admitted*

	Tuberculous	Poliomyelitis
Private practitioners	72	23
Sanatorium consultation clinics or outpatient departments	12	–
General hospitals and their outpatient departments	81	31
Other tuberculosis hospitals (by transfer)	7	–
Other sources	3	9

Table 5.—*Residence of Patients Admitted*

Tuberculosis Patients

Acushnet	1	Haverhill	1	Randolph	1
Adams	1	Holyoke	1	Reading	1
Amesbury	1	Hudson	1	Revere	4
Amherst	1	Ipswich	1	Salem	3
Arlington	2	Lawrence	2	Saugus	1
Athol	1	Lexington	1	Shrewsbury	1
Attleboro	1	Longmeadow	2	Somerville	6
Avon	1	Lowell	3	Southbridge	2
Barnstable	1	Lynn	8	Springfield	3
Belmont	3	Mansfield	1	Sutton	1
Boston	50	Medford	1	Swampscott	1
Bridgewater	3	Melrose	1	Taunton	4
Brockton	1	Methuen	1	Walpole	1
Cambridge	4	Millbury	1	Waltham	2
Canton	1	Milton	1	Watertown	2
Chelsea	2	Needham	1	Wayland	1
Cheshire	1	New Bedford	4	Webster	1
Chicopee	1	Newton	2	Weymouth	1
Everett	2	North Adams	2	Williamstown	1
Fairhaven	1	Northampton	1	Winchendon	1
Fall River	1	Norwood	1	Winchester	1
Fitchburg	2	Peabody	3	Wollaston	2
Foxborough	1	Pittsfield	3	Worcester	2
Gloucester	1	Plymouth	2		
Hanover	1	Quincy	2		175

Poliomyelitis Patients

Adams	1	Lawrence	1	Plymouth	1
Arlington	1	Leominster	1	Quincy	2
Ashland	1	Lowell	1	Salem	1
Ayer	1	Lynn	1	Somerville	4
Billerica	1	Lynnfield	1	Walpole	1
Boston	17	Malden	1	Waltham	1
Cambridge	2	Marblehead	1	Wareham	1
Danvers	1	Marlborough	1	Watertown	1
Fall River	2	Medford	1	Westford	1
Falmouth	1	Medway	1	Wilmington	1
Framingham	1	Newton	1		
Gloucester	1	Norton	1		63
Haverhill	3	Peabody	1		
Lakeville	1	Pittsfield	2		

Table 6.—*Condition on Discharge*

Tuberculosis Patients

	Adults		Children		Totals	Percentages
	Males	Females	Males	Females		
Arrested	29	27	16	21	93	46.5
Apparently arrested	6	7	3	2	18	9.0
Quiescent	20	15	–	–	35	17.5
Improved	3	3	2	1	9	4.5
Unimproved	3	1	1	–	5	2.5
Deaths	10	4	1	1	16	8.0
Not considered	2	5	1	–	8	4.0
Nontuberculous	6	1	3	6	16	8.0
	79	63	27	31	200	100.0

Poliomeylitis Patients

Improved	4	4	22	22	52	94.6
Unchanged	1	–	1	–	2	3.6
Nonpoliomyelitis	1	–	–	–	1	1.8
	6	4	23	22	55	100.0

Table 7. — *Destination of Patients Discharged Alive*

	Tuberculous	Poliomyelitis
Home	177	53
Other tuberculosis hospitals	2	–
Other institutions	5	2

Table 8. — *Deaths of Tuberculous Patients by Length of Residence in Sanatorium*

	Adults		Children		Total
	Males	Females	Males	Females	
Less than 1 month	2	–	–	–	2
1 to 3 months	–	–	–	–	–
3 to 6 months	1	–	–	–	1
6 to 12 months	1	3	1	1	6
1 to 2 years	2	1	–	–	3
Over 2 years	4	–	–	–	4
	10	4	1	1	16

TABLE 9. — *Causes of Death*

	Adults		Children		Total
	Males	Females	Males	Females	
Tuberculosis:					
Of intestines and peritoneum . .	1	1	–	–	2
Of the vertebral column . . .	4	2	–	1	7
Of the bones and joints (vertebral column excepted)	3	–	–	–	3
Of the lymphatic system (bronchial, mesenteric and retroperitoneal glands excepted)	–	1	–	–	1
Of the genitourinary system . .	2	–	1	–	3
	10	4	1	1	16

Financial Report, Lakeville State Sanatorium, 1940

To the Department of Public Health:

I respectfully submit the following report of the finances of this institution for the fiscal year ending November 30, 1940:

Statement of Earnings

Board of patients:			
Private	$5,538 50		
Cities and towns	125,345 00		
		$130,883 50	
Sales:			
Food	$584 66		
Furnishings and household supplies	25 18		
Medical and general care	77 64		
Heat, light and power	36 62		
Farm	877 25		
Garage, stable and grounds	4 46		
Products	109 81		
		$1,715 62	
Total earnings for the year			$132,599 12
Total cash receipts reverting and transferred to the State Treasurer			$126,372 81
Accounts receivable outstanding Dec. 1, 1939		$31,258 00	
Accounts receivable outstanding Nov. 30, 1940		37,484 31	
Accounts receivable increased			$6,226 31

Maintenance Appropriation

Balance from previous year, brought forward		$4,830 32
Appropriation, current year	$342,113 75	342,113 75
Total		$346,944 07
Expenditures as follows:		
Personal services	$218,073 88	
Food	38,704 75	
Medical and general care	13,178 66	
Farm	17,880 89	
Heat, light and power	16,393 50	
Garage, stable and grounds	2,104 22	
Travel, transportation and office expenses	3,425 61	
Religious instruction	1,420 00	
Clothing and materials	1,062 00	
Furnishings and household supplies	15,118 68	
Repairs, ordinary	3,986 81	
Repairs and renewals	7,734 63	
Total maintenance expenditures		$339,083 63
Balance of maintenance appropriation, Nov. 30, 1940		$7,860.44
Estimated outstanding liabilities, Nov. 30, 1940		$662 23

Special Appropriations

Balance December 1, 1939, brought forward		$1,552 50
Expended during the year (see statement below)	$331 41	
Reverting to Treasury of Commonwealth	*1,221.09	1,552.50

(Star balances below that are reverting)

Appropriation	Act or Resolve	Total Amount Appropriated	Expended during Fiscal Year	Total Expended to Date	Balance at End of Year
*Fire Protection and sprinklers	249–1934 304–1936 356–1938	$5,100 00	253 01	5,077 23	22 77
*Sewage Disposal	434–1937 356–1938	6,000 00	78 40	4,837 98	1,162 02
*Water Supply Protection	356–1938	700 00		690 15	9 85
*Dairy Unit	356–1938	25,000 00		24,973 55	26 45
		$36,800 00	$331 41	$35,578 91	$1,221 09

Per Capita

During the year the average number of patients has been		274.2923
Total cost of maintenance	$339,083 63	
Equal to a weekly per capita cost of (52 weeks to year)	23 77333	
Total receipts for the year	126,372 81	
Equal to a weekly per capita of	8 86008	
Total net cost of maintenance for year (total maintenance less total receipts)		$212,710 82
Net weekly per capita	14 91325	

Respectfully submitted,

Arthur J. Gibney,
Treasurer.

Financial Statement Verified.
Walter S. Morgan, *Comptroller.*

Inventory, Lakeville State Sanatorium

GRAND SUMMARY SHEET

November 30, 1940

Real Estate

Land, 205.86 acres		$17,890 00	
Buildings		478,905 20	
Betterments (additions and improvements)		187,200 02	
Total Real Estate			$683,995 22

Personal Property Undistributed Supplies

(Total of Departmental Sheets)

Travel, transportation and office expenses		$367 41	
Food		5,303 72	
Clothing and materials		27 33	
Furnishings and household supplies		1,758 84	
Medical and general care		3,726 15	
Heat, light and power		983 42	
Farm		704 68	
Garage, stable and grounds		88 39	
Repairs		2,118 44	
Total			$15,078 38

Personal Property Distributed Supplies

(Total of Departmental Sheets)

Travel, transportation and office expenses		$6,330 98	
Clothing and materials		1,164 64	
Furnishings and household supplies		78,785 66	
Medical and general care		42,145 25	
Heat, light and power		99 95	
Farm:			
Livestock	$20,800 50		
All other	14,886 78		
		35,687 28	
Garage, stable and grounds		4,743 62	
Repairs		7,492 07	
Total			$176,449 45

Grand Summary

Real Estate—Total	$683,995 22	
Personal Property—Undistributed Supplies, Total	15,078 38	
Personal Property—Distributed Supplies, Total	176,449 45	
Total		$175,523 05

NORTH READING STATE SANATORIUM

Carl C. MacCorison, M.D., *Superintendent*

Report of the Superintendent

To Paul J. Jakmauh, M.D., *Commissioner, Department of Public Health:*

I have the honor of submitting the thirtieth annual report of the North Reading State Sanatorium for the year ending November 30, 1940.

Financial Statement

During the year there has been expended for maintenance $262,157.72, a gross weekly per capita cost of $21.7118. There have been no expenditures from special appropriations during 1940.

There has been collected from miscellaneous sources $66,269.72 (the total of all collections). Deducting this amount from the gross maintenance expenses leaves a net expense of $195,888.00. The net weekly per capita cost was $16.2234. There has been collected from private funds $2,918.00; cities and towns $62,428.00; 14 cases (including 5 from Division of Child Guardianship) were supported by private funds; 234 by cities and towns and 70 wholly by the State.

Population

There were 218 patients at the beginning of the year and 230 at the close of the year. The largest number present at any one time was 253 and the smallest number at any one time was 216. The daily average number of patients was 232.20 as against 238.51 last year. There were 145 patients admitted during the year, 16 less than last year. There were 115 patients admitted from cities and towns of over 25,000 population and 30 patients from cities and towns under 25,000. The average age of patients was 10.0 years as against 9.48 last year.

Including deaths, there were 133 persons discharged and the average duration of residence was 16 months and 7 days.

Of the discharges 12 were apparently well; 64 arrested; 22 apparently arrested; 2 quiescent; 7 improved; 14 unimproved; 2 not considered. There were 10 deaths, 3 less than last year.

There were 84,938 hospital days.

Average number of officers and employes;

Males	*Females*	*Total*
76.66	105.41	182.07

Medical Report

During the past year 76 patients received pneumothorax and 2,157 refills were given. Of this number 138 were given to ex-patients and outpatients. Three patients had phrenic nerve operations. Three patients had pneumolysis and 1 patient had bronchoscopy.

We had an epidemic of chicken pox, which began in May, and 28 children developed the disease. One child was diagnosed as having scarlet fever.

Seven eye, ear, nose and throat clinics were held, and 68 children were referred to these clinics. Twenty-three were fitted for glasses. Tonsils and adenoids were removed from 11 patients.

One of the Public Health Nursing Supervisors from the Division of Child Hygiene tested the hearing of 119 patients by audiometer on January 24th. Thirty-three were found defective and 12 recommended for treatment. A retest on March 26th showed 21 defective out of 41 children. Nine were recommended for treatment. On September 1st she again tested the hearing of 118 children with the audiometer and retested 36 on September 13th. Eight had sufficient hearing loss to recommend special treatment.

The total number of patients seen in our outpatient clinic this year is 2,678 as against 2,324 last year. The following table gives the number of patients seen in our outpatient department, and includes those seen in the consultation clinics of Lawrence, Haverhill, Chelsea, Revere and Winthrop:

	Consultation Clinics	Outpatients	Total
New patients seen	247	843	1,090
Old cases	369	1,119	1,488
Number of visits	616	1,962	2,578
Diagnoses made (new patients)			
Negative for tuberculosis	5	29	34
*Pulmonary tuberculosis	17	34	51
Tuberculosis suspect	225	777	1,002
*Childhood type tuberculosis		3	3

*(In the consultation clinics, the pulmonary and childhood type have been included as positive.)

Institution Activities

The following clinics and meetings were held at the Sanatorium during the year:

January 23, 1940. Graduating class of Malden Hospital
February 29, 1940 Directors' meeting of the Southern Middlesex Health Association
July 12, 1940 Dr. Higgins' class in Pediatrics
November 21, 1940 Students from the School of Medicine, Middlesex University

In addition to these, lectures on tuberculosis were delivered to the student nurses of the Melrose and Chelsea Memorial Hospitals.

Improvements and Changes

The following repairs and changes were made during the year: replacing water lines; repair of laundry machinery; replacement of Permutit water filters; replacing old lockers; laying linoleum; repairs to sprinkler system.

Acknowledgments

I am greatly indebted to our clergymen for their faithful work with our patients in their religious capacity.

To the many friends who have given so freely of their time and talents to entertain our patients we feel much indebted, as well as to the employes of the institution who have supported me during the year.

For the unfailing support and cooperation I have received from members of the Department, I am duly grateful.

Respectfully submitted,
Carl C. MacCorison, M.D.,
Superintendent.

Laboratory Report

	Number
Blood:	
1. Clinical Pathology:	
Red blood cell counts	369
White blood cell counts	451
Haemoglobin	359
Differential counts	445
Sedimentation rate	589
Coagulation time	15
2. Chemistry:	
Blood sugar tests	54
Nonprotein nitrogen	4
Sulfapyridine tests	8
3. Bacteriology:	
Widal tests	66
Blood for Hinton	12
Sputum:	
Smears	949
Concentration	38
Cultures	14
Pleural Fluids:	
Smears	51
Cultures	30
Spinal Fluids:	
Cell counts	2
Chemical	2
Cultures	2
Urine:	
Routine chemical and microscopic	2,332
Special chemical	5
Cultures	15
Feces:	
Occult blood	9
Ova	21
Stomach Contents:	
Tubercle bacilli (concentration tests)	5
Pathology:	
Pus smears	95
Pus cultures	20
Nose and throat smears and cultures	21
Milk:	
Babcock tests	52
Bacteria counts of milk	52
Total	6,102

Dental Report

Prophylactic treatments 300; fillings (permanent teeth) 491; fillings (temporary teeth) 109; extractions (permanent teeth) 153; extractions (temporary teeth) 255; treatments 47; restorations 1; X-rays 49; irrigations 5; visits 1,368; new patients 59; dismissals 63; dental examinations 597; total number operating hours 633.

School Report

This is the first year we have granted North Reading State Sanatorium High School diplomas. In June two students completed their high school requirements and were graduated. Eleven received eighth grade diplomas.

Seventy-three pupils attended summer school. These young people covered a wide range of subject matter, from first grade through high school. The work done by the individual also varied greatly. Some had help in one subject, while others, who had been absent from school, had work to make up in all subjects. Forty-one, who would otherwise have had to repeat their grades, earned promotions. Nine were helped over difficult places. Twenty-three high school students earned additional credits. This work in the summer school makes it possible for these young people to keep up with their grade requirements, and this is very important.

Each year the Sanatorium school presents a problem different from that of the preceding year. As the children in the institution go and others come, the school must be ready to meet the needs of the new patients.

This year our kindergarten is small, thirteen in number. Three or four of these children are under regular kindergarten age but they are sufficiently mature to receive benefit from that program.

There are twenty pupils in the first grade, twenty-one in the second and third combined and also twenty-one in the combined fourth and fifth grades. The sixth grade is comparatively small, having fourteen pupils.

There are sixteen pupils in the seventh grade and thirteen in the eighth. These young people present the same picture that we had two years ago when Dr. Cooper advised separating the two grades. There is a wide difference in the mentality of the pupils in each grade. These individual variations necessitate a graded program to fit their several capabilities. The problem thus presented is difficult of solution even with one grade, in two hours and twenty minutes. It is really not practical to attempt to handle the two grades in the same room. This particular work is so planned that these two grades may be combined at any time if it becomes advisable to do so.

There are forty-seven students enrolled in the high school. This is the largest number we have ever had. With one or two exceptions we are able to give these people the required amount of subject matter that will be accepted as credits toward graduation in their home schools. Geometry and Junior Business Training have been added to the curriculum.

The academic requirements are so great this year, it has been impossible to carry on many of the extracurricular activities conducted last year. At present, there are two classes, a group of lower grade pupils Tuesday afternoon and a group of high school students Thursday forenoon. Remedial work in Algebra is also taught the last two periods of every forenoon, excepting Thursday.

A Student Council was organized in January, 1939. It was conducted during the remainder of that school year by the teachers. At the beginning of the school year 1939–1940, student officers were elected and the name was changed to Student Cooperative Association. During that year a constitution was drawn up and the organization became well established.

This year the work is progressing in a very satisfactory and creditable manner. The first installation of officers was held November twenty-second. In this organization teachers and pupils are working together to solve the problems of school government. Thus we are not only learning, but we are also putting into practice the principles of democracy. These activities require very careful planning and supervision on the part of the teachers. However, the results, so far, have more than justified the added work.

During a period of several years the number of pupils incapacitated for physical activity has been steadily increasing. The number thus incapacitated has been larger this year than at any previous time. Nevertheless, the regular schedule of physical training has been carried on through the year.

There has been from year to year an improvement in the sanatorium school and the present year offers no exception. The teaching force remains the same as last year and the total number of pupils enrolled is one hundred sixty-six.

School Statistics

	Average Daily	Per Cent of Attendance	Total Enrollment
Kindergarten	12.78	91.15	19
Grades I and II	22.34	94.33	30
Grades III and IV	19.16	96.52	30
Grades V and VI	27.22	98.13	36
Grades VII and VIII	23.03	97.93	33
Grades IX and XI	15.83	97.79	19
Grades X and XII	19.08	97.34	27
Entire school	139.44	95.88	194

Statistical Tables

Table 1. — *Admissions and Discharges*

	Males	Females	Total
Patients in Sanatorium December 1, 1939	95	123	218
Patients admitted from December 1, 1939, to November 30, 1940, incl.	71	74	145
Patients discharged from December 1, 1939, to November 30, 1940, incl.	60	73	133
Patients remaining in Sanatcrium November 30, 1940	106	124	230
Deaths included in number discharged	3	7	10
Daily average number patients	103.70	128.51	232.21

Table 2. — *Diagnosis and Stage of Disease on Admission*

	Males	Females	Total	Percentages
Childhood type tuberculosis	35	22	57	39.3
Minimal	8	15	23	15.9
Moderately advanced	5	9	14	9.6
Advanced	4	7	11	7.6
Miliary tuberculosis	0	1	1	.7
Tuberculous pleurisy with effusion	4	0	4	2.7
Tuberculous dactylitis	0	1	1	.7
Hydrocephalis and childhood type tuberculosis	1	0	1	.7
Bronchiectasis	1	0	1	.7
Lung abscess	0	2	2	1.4
Empyema	1	3	4	2.7
Bronchial asthma	0	3	3	2.1
Resolving pneumonia	0	1	1	.7
Congenital heart disease	1	0	1	.7
No disease	0	1	1	.7
Nontuberculous	5	6	11	7.6
Observation	1	1	2	1.4
Unclassified	1	0	1	.7
Deferred	4	2	6	4.1
Total	71	74	145	100.0

Table 3.—*Age of Patients Admitted*

	Males	Females	Total	Percentages
Under 5 years	17	10	27	18.6
5 to 9 years	20	20	40	27.6
10 to 14 years	20	27	47	32.4
15 to 19 years	14	17	31	21.4
20 years and over	0	0	0	–
Average age	9.2	10.6	10.0	–
Total	71	74	145	100.0

Table 4. — *Residence of Patients Admitted*

Acton	1	Gloucester	1	Peabody	1
Amesbury	1	Haverhill	5	Quincy	2
Andover	1	Holyoke	1	Reading	1
Arlington	2	Hudson	1	Revere	2
Ashburnham	1	Huntington	1	Rutland	1
Ashland	1	Lawrence	8	Salem	2
Beverly	1	Leominster	1	Shrewsbury	1
Boston	44	Lowell	4	Somerville	5
Brookline	1	Lynn	9	Springfield	1
Cambridge	5	Malden	5	Taunton	2
Chelsea	3	Marblehead	1	Townsend	1
Chicopee	1	Medford	2	Waltham	3
Danvers	1	Methuen	2	Wellesley	1
Dracut	1	Needham	1	Westford	1
Easthampton	1	New Bedford	2	Winthrop	1
Everett	2	Newburyport	2	Woburn	1
Fitchburg	1	Newton	1		
Foxborough	1	Northbridge	1	Total	145
Framingham	1	Northampton	1		

Table 5.—*Condition on Discharge*

	Males	Females	Total	Percentage
Apparently well	5	7	12	9.0
Arrested	38	26	64	48.1
Apparently arrested	6	16	22	16.5
Quiescent	0	2	2	1.6
Improved	1	6	7	5.2
Unimproved	5	9	14	10.5
Died	3	7	10	7.5
Not considered	2	0	2	1.6
Total	60	73	133	100.0

Table 6.—*Deaths by Length of Residence in Sanatorium*

	Males	Females	Total
Less than 1 month	0	1	1
1 to 3 months	1	0	1
3 to 6 months	2	2	4
6 to 12 months	0	3	3
1 to 2 years	0	0	0
Over 2 years	0	1	1
Total	3	7	10

Table 7.—*Causes of Death*

	Males	Females	Total
Tuberculosis of the lungs	2	5	7
Miliary tuberculosis of lungs	0	1	1
Tuberculosis of the meninges	1	0	1
Tuberculous meningitis and tuberculosis of the lungs	0	1	1
Total	3	7	10

Table 8.—*Source of Referral of Patients Admitted*

Private practitioners	54
Sanatorium consultation clinics or outpatient departments	24
General hospitals and their outpatient departments	45
Other tuberculosis hospitals (by transfer)	1
Other sources	21
	145

Table 9.—*Reason for Initial Examination of Tuberculous Patients Admitted*

Contact with a person having tuberculosis	49
Suspicious symptoms or signs	88
Routine examination (school, industry, etc.)	8

Table 10.—*Destination of Patients Discharged Alive*

Home	108
Other tuberculosis hospitals	6
Other Institutions	9

Financial Report, North Reading State Sanatorium, 1940

To the Department of Public Health:

I respectfully submit the following report of the finances of this institution for the fiscal year ending November 30, 1940:

Statement of Earnings

Board of patients:			
Private	$3,028 00		
Cities and towns	62,095 00		
		$65,123 00	
Sales:			
Food	$ 1 75		
Clothing and materials	162 56		
Furnishings and household supplies	43 15		
Medical and general care	61 74		
Heat, light and power	4 50		
Farm	7 55		
Garage, stable and grounds	50 69		
Repairs, ordinary	2 00		
Miscellaneous—junk	103 50		
Total Sales		$437 44	
Miscellaneous:			
Rents (Garages)	$494 50		
Total, miscellaneous		$494 50	
Total earnings for the year			$66,054 94
Total cash receipts reverting and transferred to the State Treasurer			66,269 72
Accounts receivable outstanding Dec. 1, 1939		$13,440 73	
Accounts receivable outstanding Nov. 30, 1940		13,225 95	
Accounts receivable decreased			214 78

Maintenance Appropriation

Balance from previous year, brought forward		$135 49
Appropriation, current year	$276,785 20	
		276,785 20
Total		$276,920 69
Expenditures as follows:		
Personal services	$179,737 89	
Food	41,038 08	
Medical and general care	7,865 05	
Farm	3,143 46	
Heat, light and power	14,517 56	
Garage, stable and grounds	1,046 55	
Travel, transportation and office expenses	2,248 34	
Religious instruction	1,600 00	
Clothing and materials	1,073 30	
Furnishings and household supplies	4,837 44	
Repairs, ordinary	2,711 38	
Repairs and renewals	2,328 48	
Total maintenance expenditures		$262,147 53
Balance of maintenance appropriation, Nov. 30, 1940		$14,773 16
Estimated outstanding liabilities, Nov. 30, 1940		$1,109 90

Per Capita

During the year the average number of patients has been		232 20
Total cost of maintenance	$262,147 53	
Equal to a weekly per capita cost of (52 weeks to year)	21 7110	
Total receipts for the year	66,269 72	
Equal to a weekly per capita of	5 4884	
Total net cost of maintenance for year (total maintenance less total receipts)		$195,877 81
Net weekly per capita	16 2226	

Respectfully submitted,

Ethel M. Knight,

Treasurer.

Financial Report Verified

Walter S. Morgan, *Comptroller.*

Inventory: North Reading State Sanatorium

GRAND SUMMARY SHEET

November 30, 1940

Real Estate

Land, 115.11 acres		$11,178 00	
Buildings		546,606 85	
Betterments (additions and improvements)		134,128 62	
Total, Real Estate			$691,913 47

Personal Property Undistributed Supplies

(Total of Departmental Sheets)

Travel, transportation and office expenses		$172 08	
Food		5,067 78	
Clothing and materials		1,445 94	
Furnishings and household supplies		2,216 13	
Medical and general care		1,203 32	
Heat, light and power		14 83	
Farm		156 56	
Garage, stable and grounds		124 46	
Repairs		326 84	
Total			$10,727 94

Personal Property Distributed Supplies

(Total of Departmental Sheets)

Travel, transportation and office expenses		$5,298 34	
Clothing and materials		3,042 28	
Furnishings and household supplies		79,283 98	
Medical and general care		43,472 26	
Heat, light and power		800 06	
Farm:			
Livestock	$2,894 85		
All other	4,747 53		
		7,642 38	
Garage, stable and grounds		7,154 32	
Repairs		4,304 57	
Total			$150,998 19

Grand Summary

Real Estate—Total	$691,913 47	
Personal Property—Undistributed Supplies, Total	10,727 94	
Personal Property—Distributed Supplies, Total	150,998 19	
Total		$853,639 60

RUTLAND STATE SANATORIUM

Ernest B. Emerson, M.D., *Superintendent*

Report of the Superintendent

To Paul J. Jakmauh, M.D., *Commissioner, Department of Public Health:*

I have the honor to submit the forty-fourth annual report of the Rutland State Sanatorium for the year ending November 30, 1940.

Financial Report

During the year there has been expended $357,265.67 for maintenance, a gross weekly per capita cost of $24.38, an increase of $1.76 over 1939 due to the decrease in the daily average number of patients.

There have been no expenditures from Special Appropriation authorized by Chapter 507, Acts of 1938, Hurricane and Flood Damage.

There has been collected from miscellaneous sources $84,719.63, a decrease of $19,522.95 from the collections of 1939. Deducting the total collections from the gross maintenance expense leaves a net expense of $272,546.04, a net weekly per capita cost of $18.60. There has been collected from private sources $15,167.00; from cities and towns, $25,643.00; from the Tubercular District of Chelsea, Revere and Winthrop, $24,080.07; from Hampden County, $17,497.50; from the Division of Child Guardianship, Department of Public Welfare, $795.00.

Forty cases were supported wholly or in part by private funds; sixty-one cases by cities and towns; twenty-nine cases by the Tubercular District of Chelsea, Revere and Winthrop; two cases by the Division of Child Guardianship, Department of Public Welfare, and one hundred and three cases wholly by the State. There were forty cases on which settlement had not been determined.

Population

There were 297 patients in the sanatorium at the beginning of the year, and 275 at the close. The largest number present at one time was 307 and the smallest 262. The daily average number of patients was 281.8, a decrease of 36.5 from last year. There were 226 patients admitted during the year, 1 less than last year: 19 minimal; 76 moderately advanced; 104 far advanced; 11 unclassified; 1 mitral stenosis and regurgitation, aortic stenosis and regurgitation; 8 pleurisy (unknown origin); 1 tuberculous larynx; 1 silicosis; 1 lues, bronchial asthma, myocardial damage and hypothyroidism; 1 pleurisy with effusion, probably tuberculous; 1 bronchial asthma and bronchiectasis; 1 healed primary infection, and 1 congenital cystic disease of both lungs. There were 157 admitted from cities and towns over 25,000 population, and 69 from cities and towns under 25,000 population. The average age of patients admitted was 34.3, an increase of 1.0 year. Including deaths, there were 248 patients discharged, 17 less than last year. The average duration of residence was 478 days, 23 less than last year. Of the discharged, there were 3 arrested cases, 7 less than last year, 24 apparently arrested, 1 less than last year, 102 quiescent, 18 more than last year, 30 improved, 10 less than last year, 14 unimproved, 1 healed pulmonary tuberculosis, 5 nontuberculous, 1 healed tuberculosis and bronchiectasis, 2 pleurisy (recovered), 1 cystic disease (recovered), and 9 not considered, the duration of treatment being less than one month. There were 55 deaths, 11 less than last year. There were 103,141 days of treatment, 3,055 less than last year.

Average number of employees and officers during the year: males 132.2, females 87.3, total 219.5.

Further statistical details are shown in the tables which are a part of this report.

Medical Report

The Worcester District Medical Society held its fall meeting at the Sanatorium October 9, 1940. Dr. Paul Dufault presented a paper on "The Danger of Infection from Tuberculosis Among Hospital Personnel," and Dr. A. Reynolds Crane presented a paper on "The Late Manifestations of Pyelonephritis." The Wachusett

Medical Society held a meeting at the Sanatorium November 6, 1940 and Dr. I. L. Cutler presented the following: "Pneumonectomy in Tuberculosis, a Case Report." During the year Dr. Paul Dufault has also written the following: "Assistance Post-Sanitoriale" presented during Tuberculosis Week in August, 1940 at Sacre-Coeur Hospital, Montreal. "Tuberculeux Hospitalisables" presented before a bi-annual prevention assembly, Three Rivers, Quebec, September, 1940. "Emotions, Reactions, Redressments" presented during Clinic week before L'Societe Medicale de Montreal, October, 1940.

The following table indicates the work of the consultation and outpatient services:

Clinic Examinations

	Consultation	Outpatients	Total
New patients seen	509	220	729
Old cases	253	320	573
Number of visits	774	605	1,379
Diagnoses made (new patients)			
Negative for tuberculosis	377	192	569
Pulmonary tuberculosis	16	14	30
Tuberculosis suspect	110	10	120
Primary infection	6	4	10

Institutional Activities

The following were awarded diplomas after completion of the three-year course in the training school: Josephine Grace Robertson and Lillian Rose Waters.

The following were awarded certificates after completion of the eighteen months' course in tuberculosis nursing:

Florence DeLaura Silva
Elsie Mae Walker
Jeanette Lange
Elva Davis Gutowski
Isabel Lapan
Margaret E. Little

A teacher-librarian was appointed under W. P. A. February 2, 1940. This project is not only a most valuable means of occupational therapy but, what is of far more importance, it is a worthwhile attempt at rehabilitation. The following table shows the course of instruction during the past 10 months:

Course	Males	Females	Total
Vocabulary building	9	2	11
Elementary English and rhetoric	6	2	8
Business English	0	5	5
English for new Americans	2	0	2
Plain English	2	0	2
Short story	1	1	2
English literature	0	2	2
Journalism	1	0	1
Elementary arithmetic	1	0	1
Business arithmetic	0	1	1
Civil service arithmetic	4	0	4
Accounting	5	2	7
Cost accounting	2	0	2
Bookkeeping	6	3	9
Shorthand	4	5	9
Salesmanship	1	0	1
Penmanship	1	0	1
Foremanship training	1	0	1
Carpentry	1	0	1
Radio	3	0	3
Mechanical drawing	5	0	5
Fashion drawing	0	2	2
Freehand drawing	2	3	5
Interior decorating	0	2	2
Industrial electricity and wiring	2	0	2
Elementary German	2	3	5
Elementary Latin	2	0	2
Elementary French	1	2	3
Elementary Italian	1	0	1
Cicero	1	0	1
Class—English grammar	0	10	10
Class—book discussion	0	8	8
	66	53	119

I recommend that this position be made a permanent part of our personnel.

Improvements and Changes

The following equipment has been purchased during the year: One hundred Gatch beds, 1 oxygen tent, 1 autopsy table, 1 diagnostic X-ray table, 1 hay chopper, 1 tractor cab and plow, 1 floor machine and 1 delicator.

Recommendations

In previous reports I have called attention to the inadequacy of the present buildings, and also to the fire hazard which is far more than an ordinary menace to the safety of our patients. A fire occurred during the afternoon of June 30, 1940, in Ward D, presumably due to defective wiring. Such a fire occurring at night during a winter storm might well lay waste the entire institution before it would be possible for outside assistance to arrive. Should such a catastrophe occur, patients and employees alike would have no place of refuge save the sheds and barn, and even these are not readily accessible during the height of a blizzard when it is impossible for any highway department to keep ahead of drifting snow. The present wards constitute a firetrap of the first magnitude and should be replaced by at least fire resisting construction.

Acknowledgments

Again I am indebted to our chaplains for their assistance in the welfare of our patients, and I am deeply appreciative of the loyalty of the employees who have made possible whatever may have been accomplished during the year.

I am deeply grateful for your confidence and support during the year.

Respectfully,

Ernest B. Emerson, M.D.,
Superintendent.

Surgical Report

The following is a list of the surgical operations performed at the sanatorium:

Abdominal adhesions	1
Appendectomy	9
Blood transfusions	1
Bronchoscopies	98
Circumcision	1
Cystoscopy	4
Debridement and reduction	1
Dilatation and curettage	2
Dilatation and curettage and cauterization of cervix	1
Excision of anal polyp	1
Excision of growth in breast	1
Excision of hydrocele	1
Excision of pilonidal cyst	1
Excision of wen	1
Excision of ovarian cyst	2
Fistulotomy	6
Hemorrhoidectomy	1
Herniorrhaphy	3
Incision and drainage of cold abscess	1
Incision and drainage of ischiorectal abscess	1
Intrapleural pneumolysis	43
Iridotomy	1
Laparotomy, excision of fistulous tract, and anterior gastroenterostomy	1
Phrenic emphraxis	1
Reduction of fracture	1
Salpingo-oophorectomy	1
Tonsillectomy	9
Thoracotomy	3

Artificial pneumothorax treatments	5,122
Aspirations of pleural cavity	308
Total patients given pneumothorax during the year	233
Number of patients receiving pneumothorax at end of year	114
Total outpatients given pneumothorax during the year	84
Number of outpatients receiving pneumothorax at end of year	71

There were 30 thoracoplasties performed at the Massachusetts General Hospital; also 2 pneumonectomies.

Laboratory Report

Blood	
1. Clinical Pathology	
Red blood cell count	312
White blood cell count	1,509
Differential count	1,503
Hemoglobin (Hellige)	1,452
Sedimentation test	1,449
Hematocrit	1,449
Icterus index	250
Coagulation time	77
Bleeding time	2
2. Chemistry	
Sugar	160
Nonprotein nitrogen	12
Congo red test	10
3. Bacteriology and Serology	
Culture	5
Blood grouping	18
Blood matching	1
Sputum	
Smear for tubercle bacilli	2,610
Culture for tubercle bacilli	1,711
Guinea pig inoculation	63
Pleural Fluid	
Culture	624
Smear	210
Guinea pig inoculation	2
Red blood cell count	2
Specific gravity	10
Spinal Fluids	
Cell count	9
Chemical	4
Culture	1
Smear	1
Guinea pig inoculation	1
Urine	
Routine analysis	711
Special chemical	3,292
Concentration test	14
Kidney function (P.S.P.) test	8
Culture	12
Guinea pig inoculation	20
Feces	
Occult blood	12
Tubercle bacilli, ova, etc.	13
Stomach Contents	
Acidity	6
Smear	24
Guinea pig inoculation	23
Miscellaneous Examinations	
Culture	48
Smear	53
Babcock test for fat	3
Pathology	
Surgical specimens	36
Autopsies (29.0%)	16
Microscopical sections (paraffin)	617
Total	18,365

Specimens sent to Central Laboratory	
Cultures from urine and feces for B typhosus	60
Blood for Widal test	33
Blood for Hinton test	262
Spinal fluid for Hinton and Wassermann tests	8

Of the total number of patients (275) in Sanatorium November 30, 1940, 90.9% have been found positive by sputum or stomach contents examination; in 9.1% tubercle bacilli were not found.

	Inpatients	Outpatients	Total
X-rays	1914	990	2,904
Clinic films developed at this sanatorium			762
Photographs taken			355
Prints made			1,168
Lantern slides made			189
Electrocardiograms			76
Metabolism tests			10

Smallpox vaccinations	252
Typhoid and paratyphoid A and B inoculations	251

Dental Report

The following is a summary of the dental work done during the year:

Number of visits	2,435
Number of patients	248
Examinations	198
Prophylactic treatments	147
Fillings	453
Extractions	385
Post extractions	450
Restorations	12
Local anesthesia	391
Root canal fillings	2
Irrigations	385
Pyorrhea, Vincent's disease, and stomatitis treatments	116
Oral surgical operations	12
X-rays	428
Ankylosis and osteomyelitis cases	6

Statistical Tables

Table 1.—*Admissions and Discharges*

	Males	Females	Total
Patients in Sanatorium November 30, 1939	162	135	297
Patients admitted December 1, 1939 to November 30, 1940, inclusive	121	105	226
Patients discharged December 1, 1939 to November 30, 1940, inclusive	135	113	248
Patients remaining in Sanatorium November 30, 1940	147	128	275
Daily average number of patients	160.3	121.5	281.8
Deaths (included in number discharged)	33	22	55

Table 2.—*Diagnosis and Stage of Disease on Admission*

	Males	Females	Total	Percentage
Minimal	11	8	19	8.4
Moderately advanced	40	36	76	34.0
Far advanced	60	44	104	46.0
Unclassified	4	7	11	4.9
Healed primary infection		1	1	.4
Tuberculosis of larynx		1	1	.4
Pleurisy with effusion and peritoneal tuberculosis		1	1	.4
Pleurisy (unknown origin)	4	4	8	3.5
Mitral stenosis and regurgitation, aortic stenosis and regurgitation	1		1	.4
Silicosis	1		1	.4
Lues, bronchial asthma, myocardial damage and hypothyroidism		1	1	.4
Bronchial asthma and bronchiectasis		1	1	.4
Congenital cystic disease of both lungs		1	1	.4
	121	105	226	

Table 3.—*Ages of Patients Admitted*

	Males	Females	Total	Percentage
Under 20 years	7	9	16	7.1
20 to 29 years	40	40	80	35.3
30 to 39 years	34	32	66	29.2
40 to 49 years	17	10	27	12.0
50 to 59 years	16	11	27	12.0
60 to 69 years	6	3	9	4.0
70 years and over	1		1	.4
Average age	35.9	32.5	34.3	
	121	105	226	

Table 4.—*Source of Referral of Patients Admitted*

	Males	Females	Total
Private Practitioners	68	50	118
Sanatorium consultation clinics or outpatient department	12	7	19
General hospitals and their outpatient departments	16	19	35
Other tuberculosis hospitals by transfer	8	16	24
Other sources	17	13	30
	121	105	226

Table 5.—*Residence of Patients Admitted*

Place	Number	Place	Number	Place	Number	Place	Number
Acushnet	1	Grafton	1	Millville	2	Southbridge	1
Arlington	1	Greenfield	2	Milton	1	Springfield	5
Attleboro	1	Groveland	1	Natick	1	Sunderland	2
Boston	70	Hancock	1	New Bedford	2	Sutton	1
Brockton	1	Harvard	1	Newton	1	Taunton	1
Brookfield	1	Haverhill	1	Northampton	1	Waltham	4
Brookline	1	Holden	1	Oxford	1	Watertown	2
Cambridge	12	Holyoke	1	Palmer	1	Wilmington	1
Charlton	1	Great Barrington	1	Pembroke	1	Winchendon	1
Chelsea	12	Ipswich	1	Reading	1	Winthrop	3
Chicopee	2	Leominster	2	Revere	15	Woburn	1
Easthampton	1	Lowell	17	Rockland	1	Worcester	4
Everett	5	Ludlow	2	Rutland	4	Wrentham	2
Fall River	1	Lynn	1	Salem	1		
Gardner	2	Malden	5	Saugus	1	Total	226
Gloucester	3	Marblehead	1	Somerville	10		

Table 6.—*Reasons for Initial Examination of Tuberculous Patients*

	Male	Female	Total
Contact with a person having tuberculosis	9	6	15
Suspicious symptoms or signs	94	79	173
Routine examination (school, industry, etc.)	8	5	13
	111	90	201

Table 7.—*Condition on Discharge*

	Male	Female	Total	Percentage
Arrested	2	1	3	1.2
Apparently arrested	14	10	24	9.7
Quiescent	49	53	102	41.1
Improved	21	9	30	12.0
Unimproved	8	6	14	5.6
Dead	33	22	55	22.0
No diagnosis	1	0	1	.4
Healed pulmonary tuberculosis	0	1	1	.4
Nontuberculous	3	2	5	2.0
Healed tuberculosis and bronchiectasis	1	0	1	.4
Pleurisy, recovered	0	2	2	.8
Cystic disease, recovered	0	1	1	.4
Not considered	3	6	9	4.0
	135	113	248	

Table 8.—*Destination of Patients Discharged Alive*

	Males	Females	Total
Home	92	82	174
Other tuberculosis hospitals	3	6	9
Other institutions	4	1	5
Remained to work in this sanatorium	3	2	5
	102	91	193

Table 9.—*Deaths by Length of Residence in Sanatorium*

	Males	Females	Total
Under 1 month	4	3	7
1 to 3 months	6	2	8
3 to 6 months	3	4	7
6 to 12 months	5	9	14
1 to 2 years	3	1	4
Over 2 years	12	3	15
	33	22	55

Table 10.—*Cause of Death*

	Males	Females	Total
Pulmonary tuberculosis	21	19	40
Intestinal obstruction, intestinal fistula, abdominal neoplasm, and pulmonary tuberculosis	1		1
Tuberculous meningitis and pulmonary tuberculosis	2		2
Pulmonary tuberculosis and rectal fistula	1		1
Embolism and pulmonary tuberculosis	1		1
Pulmonary tuberculosis and diabetes mellitus	2		2
Pulmonary tuberculosis and tuberculous laryngitis	2		2
Pulmonary tuberculosis, Addison's disease, and tuberculosis of kidneys		1	1
Pulmonary tuberculosis and bronchial asthma	1		1
Pulmonary tuberculosis, tuberculous laryngitis, tuberculous enteritis, and tuberculous peritonitis	1		1
Pulmonary tuberculosis and renal tuberculosis		1	1
Pulmonary tuberculosis, amyloidosus, and uremia	1		1
Congenital cystic disease of both lungs		1	1
	33	22	55

Financial Report, Rutland State Sanatorium, 1940

To the Department of Public Health:

I respectfully submit the following report of the finances of this institution for the fiscal year ending November 30, 1940:

Statement of Earnings

Board of patients:			
Attorney-General	$3,366 50		
Private and State minor wards	14,729 00		
Cities and towns	29,436 00		
Chelsea, Revere and Winthrop	29,121 00		
Hampden County	11,550 00		
		$88,202 50	
Sales:			
Travel, transportation and office expenss	$1 00		
Food	237 02		
Medical and general care	221 58		
Heat, light and power	1 00		
Garage, stable and grounds	36 81		
Repairs, ordinary	13 75		
Farm—Machinery	25 00		
Wood	321 48		
Live stock	109 63		
Hides	91 39		
Total sales		$1,058 66	
Miscellaneous:			
Rents	$46 94		
Board	301 30		
Fees—Medical records	5 20		
Total, miscellaneous		$353 44	
Total earnings for the year			$89,614 60
Total cash receipts reverting and transferred to the State Treasurer			84,641 21
Accounts receivable outstanding Dec. 1, 1939		$59,648 08	
Accounts receivable outstanding Nov. 30, 1940		64,621 47	
Accounts receivable increased			4,973 39

Maintenance Appropriation

Balance from previous year, brought forward		$378 62
Appropriation, current year	$379,981 87	379,981 87
Total		$380,360 49
Expenditures as follows:		
Personal services	$220,817 50	
Food	45,710 30	
Medical and general care	23,615 01	
Farm	13,442 21	
Heat, light and power	28,037 84	
Garage, stable and grounds	1,795 84	
Travel, transportation and office expenses	3,389 80	
Religious instruction	1,900 00	
Clothing and materials	261 07	
Furnishings and household supplies	9,862 00	
Repairs, ordinary	3,892 95	
Repairs and renewals	2,853 01	
Total maintenance expenditures		$355,577 53
Balance of maintenance appropriation, Nov. 30, 1940		$24,782 96
Estimated outstanding liabilities, Nov. 30, 1940		$281 84

Special Appropriations

Balance December 1, 1939 brought forward	$143 08
Reverting to Treasury of Commonwealth	*143 08
(Star balances below that are reverting)	

Appropriation	Act or Resolve	Total Amount Appropriated	Expended during Fiscal Year	Total Expended to Date	Balance at End of Year
Hurricane and Flood Damage	Chap. 507 1938	$5,400 00	–	$5,256 92	$143 08

Per Capita

During the year the average number of patients has been		281 7
Total cost of maintenance	$355,577 53	
Equal to a weekly per capita cost of (52 weeks to year)	24 27	
Total receipts for the year	84,641 21	
Equal to a weekly per capita of	5 78	
Total net cost of maintenance for year (total maintenance less total receipts)		$270,936 32
Net weekly per capita	18 49	

Respectfully submitted,

Mary A. Boyle,
Treasurer.

Financial Statement Verified.

Walter S. Morgan, *Comptroller.*

Inventory: Rutland State Sanatorium

GRAND SUMMARY SHEET

November 30, 1940

Real Estate

Land, 364.727 acres	$27,182 94	
Buildings	608,836 61	
Betterments (additions and improvements)	182,465 60	
Total, Real Estate		$818,485 15

Personal Property Undistributed Supplies

(Total of Departmental Sheets)

Travel, transportation and office expenses	$1,012 10	
Food	2,645 31	
Clothing and materials	354 03	
Furnishings and household supplies	2,597 96	
Medical and general care	5,118 06	
Heat, light and power	1,039 17	
Farm	3,609 02	
Garage, stable and grounds	83 96	
Repairs	4,225 52	
Total		$20,685 13

Personal Property Distributed Supplies

(Total of Departmental Sheets)

Travel, transportation and office expenses		$2,261 19	
Clothing and materials		470 73	
Furnishings and household supplies		54,612 92	
Medical and general care		25,585 53	
Heat, light and power			
Farm:			
Livestock	$18,227 20		
All other	17,163 48	35,390 68	
Garage, stable and grounds		2,180 12	
Repairs		1,668 92	
Total			$122,170 09

Grand Summary

Real Estate—Total	$818,485 15	
Personal Property—Undistributed Supplies, Total	20,685 13	
Personal Property—Distributed Supplies, Total	122,170 09	
Total		$961,340 37

WESTFIELD STATE SANATORIUM

Roy Morgan, M.D., *Superintendent*

Report of the Superintendent

To Dr. Paul J. Jakmauh, *Commissioner, Department of Public Health:*

I have the honor to submit the thirty-first annual report of the Westfield State Sanatorium for the year ending November 30, 1940

Financial Statement

During the year there has been expended $426,341.66 for maintenance, a gross weekly per capita cost of $38.423; and from Special Appropriations, for Fire Protection and Sprinklers, $236.07.

There has been collected from miscellaneous sources (the total of all collections), $135,904.89. Deducting this amount from the gross maintenance expense leaves a net expense of $280,173.59, a net weekly per capita cost of $26.175. There has been collected from private sources, $23,132.00 and from cities and towns $108,209.00.

Of the 171 tuberculosis patients admitted during the year, 33 cases were supported wholly from private funds; 73 cases by cities and towns; 16 wholly by the State; 5 Belchertown State School cases and 1 in part by private funds and in part by town. There were 43 cases on which settlements have not been determined.

Of the 517 cancer patients admitted for the first time during the past year, 333 were supported by private funds, 132 by cities and towns, and 37 by the State, leaving 15 settlements pending.

Tuberculosis Population

There were 176 patients in the Sanatorium at the beginning of the year and 169 at the close. The largest number of patients at any one time was 178 and the smallest number was 154. The daily average number of patients was 169.1. There were 171 patients admitted during the year and 178 were discharged, including deaths. 93 cases were admitted from cities and towns of over 25,000 population and 78 from cities and towns of less than 25,000. The average age of patients was 35.26 years. The average length of stay of patients discharged, including deaths, was 465 days. Of the 178 discharged cases, 57 were apparently arrested, 7 quiescent, 45 improved, 34 unimproved, 1 with no evidence of tuberculosis, and 34 deaths. Total hospital days of patients was 61,888.

Cancer Population

There were 39 patients in the hospital on November 30, 1939. During the year there were 716 admissions. Of these, 199 represented readmissions. Patients were received from 64 cities and towns. Patients were also received from two other State institutions. Forty-three patients remained in the hospital at the end of the year.

The number discharged during the year was 712. The condition of 191 was unchanged, 437 improved and 84 died. There were 64 autopsies.

The average period of hospitalization was 23.92 days. The largest number of patients at any one time was 49 and the smallest number was 35. The average number of patients per day was 44.28.

The average number of employees and officers during the year was 262.4.

Medical Report

Tuberculosis

No new methods of treatment have been used. Artificial pneumothorax was given in 164 of our tuberculosis house cases, 3,910 injections being given. Eighty outpatients were given refills, 1,210 injections being given to these. A detailed list of other procedures will be found in the Surgical Report.

The number of pulmonary cases discharged during the year was 160. Pneumothorax treatment was tried in 79 of these, successfully in 50 and unsuccessfully in 29. Pneumolysis was used in 26, phrenic crushing in 6, phrenicotomy in 1, and thoracoplasty in 13 cases.

Our Tuberculosis Outpatient Department has had a successful year. There were 5,306 visits to this department, a fair increase over the previous year. In cooperation with the Hampden County Tuberculosis Association, we conducted a special clinic in Palmer and two clinics in Ludlow. As in the past, we have furnished medical supervision for Camp Frederic Edwards during this summer; all children, numbering 44, were tuberculin-tested and X-rayed at the camp.

The regular monthly clinics have been held in Greenfield; a total of 385 cases were examined. The clinics in Great Barrington and North Adams have been continued. We started a monthly clinic in Chicopee in February.

We X-rayed 25 children at the Greenfield Health Camp in July. We also X-rayed 226 Smith College students in October. Mount Holyoke students were X-rayed on three occasions, making a total of 323 X-rays; their employees, numbering 164, were also X-rayed.

Clinic Examinations

	Consultation Clinics	Outpatients	Total
New patients seen	504	2,674	3,178
Number of visits	959	4,347	5,306
Diagnoses made (new patients)			
Negative for tuberculosis	474	2,457	2,931
Pulmonary tuberculosis	11	152	163
Tuberculosis suspect	19	65	84

Cancer

Our Cancer Outpatient Clinic has had a busy year. Fifty-one Wednesday clinics were held during the year with a total number of 4,068 visits. The average attendance was 80. Patients making their first visit to the clinic numbered 1,203. Exclusive of the regular Wednesday Clinic, there were 2,283 visits, 31 of these being new patients. Total clinic visits were 6,351. There were 384 clinic patients who subsequently were admitted to the hospital.

Institution Activities

The following clinics and meetings were held at the hospital during the year:

International College of Surgeons—New England Section—December 13, 1939.
Minister's Association—April 1, 1940.
Smith College Students—April 22, 1940.
Hampden County Medical Society Meeting—April 30, 1940.
Unveiling of tablet in memory of Monsignor Roche, erected by Western Massachusetts Past Regents Club, Daughters of Isabella—May 19, 1940.
State Librarian Association—May 24, 1940.
Western Massachusetts Health Meeting—June 6, 1940.
Preschool Health Supervisor Institute—June 13, 1940.
Biannual Cancer Clinic—November 20, 1940.

The following groups have been addressed outside the institution by members of our staff:

Southwick Women's Club, Southwick Congregational Church—February 6, 1940.
Ladies' Aid Society of the Methodist Church, Mittineague—March 7, 1940.
Junior Sodality, St. Mary's Church, Westfield—Winter.
Waterbury Medical Association, Waterbury, Connecticut—May, 1940.
Doctor's Club, Springfield—May, 1940.
New England Pathological Society, Portland, Maine—June, 1940.
Brookfield Medical Society, Ware—October 16, 1940.

A radio talk on "The Importance of the Medical Laboratory" was given over Station WMAS, Springfield, on January 7, 1940 under the auspices of The Springfield Health Department.

A twelve-lecture program was given to the patients over the hospital radio system.

Improvements and Changes

Nothing but very minor improvements have been made during the year. We have a new institution which is well-equipped and we feel that no important changes or improvements will be necessary for a while.

Recommendations

We have no particular recommendations for the coming two years except for a few minor repair and renewal items which have been included in the budget.

Acknowledgments

I wish to sincerely thank all the members of the staff and employees for their continued cooperation and loyalty. I also wish to express my appreciation to the clergymen who have rendered their services and interest so faithfully to our patients.

Respectfully submitted,

Roy Morgan, M.D.,
Superintendent.

Surgical Report

Tuberculosis

Adenoidectomy	1	Extrapleural pneumolysis	2
Appendectomy	2	Intrapleural pneumolysis	34
Biopsy	4	Rectal operations	1
Bronchoscopy	20	First stage thoracoplasty	18
Cystoscopy	1	Second stage thoracoplasty	23
Drainage of empyema	1	Third stage thoracoplasty	4
Excision	8	Fourth stage thoracoplasty	1
Laryngoscopy	3	Thoracoscopy	6
Miscellaneous operations	4	Tonsillectomy	3
Phrenic crushing	8		
Total			144
Artificial pneumothorax treatments			5,120

Cancer

Operations: Major 300; minor 441; procedures without anesthetics, 520. Total procedures, 1,261. Of these procedures, 642 were biopsies, 20 bronchoscopies, 327 cystoscopies, 4 gastroscopies, 41 laryngoscopies, 1 laryngoscopy-bronchoscopy-tracheoscopy, 103 proctoscopies, 241 transfusions, 23 esophagoscopies, 5 laryngoscopy-esophagoscopies, 1 laryngoscopy-bronchoscopy-esophagoscopy, 1 vaginal examination, 11 laryngoscopy-bronchoscopies, 1 cast applied.

An anesthetic was given 1,649 times: Cocaine, 63; gas-oxygen-ether, 250; evipal, 4; larocaine-cocaine, 84; novocaine, 942; nupercaine, 139; pantocaine, 1; ether, 2; spinal, 87; spinal-gas-oxygen-ether, 15; spinal-novocaine-gas-oxygen-ether, 3; larocaine, 19; sacral, 6; novocaine-butyn, 1; vinethene-ether, 1; novocaine-gas-oxygen-ether, 3; novocaine-ether, 1; novocaine-cocaine, 2; novocaine-evipal, 1; ether-oxygen, 3; novocaine-spinal, 4; sodium pantothal, 13; novocaine-ethyl chloride, 1; gas-oxygen, 3; spinal-novocaine-gas-oxygen, 1.

X-ray and Radium: X-ray treatments, 7,837; radium treatments, 114; total films exposed for diagnosis, 5,545; arteriographs, 4; breast series, 156; lipiodol chests, 28; lower G. I. series, 216; retrograde pyelograms, 55; skiodans, 278; upper G. I. series, 346; photographs, 424; esophageal examinations, 38; gallbladder, 25; fluoroscopies, 22; pneumoperitoneum, 4; venograms, 2; cystograms, 5; uterographs, 1; air injection, 2; dental, 4; barium injection, 1.

Laboratory Report

Blood

1. Clinical Pathology

Red blood cell counts	2,202
White blood cell counts	2,248
Differential counts	1,995
Hemoglobin estimations	2,277
Sedimentation rates	228
Platelet counts	17
Bleeding times	19
Coagulation times	18
Prothrombins	19
Reticulocyte counts	4
Volume index	9
Color index	1

2. Chemistry

Sugar	135
Nonprotein-nitrogen	1,100
Total protein	288
Albumin-globulin ratio	82
Van den Bergh tests	52
Icterus index	48
Sulfanilamide	82
Vitamin C	40
Uric acid	14
Thiocyanate	6
Cholesterol	7
Blood chlorides	182
Sulfapyridine	22
Quick liver function	1
Glucose tolerance	3
Congo Red Tests	2
Blood calciums	3
Blood phosphate	26
Uric chlorides	1
Serum phosphate	2
Hematocrit	164
CO_2 combining power	142
Neoprontosil	2
Phosphatase	24
Takata ara	1
Sulfathiozole	8

3. Bacteriology and Serology

Blood cultures	51
Blood groupings	1,676
Rapid Hinton tests	542
Bloods for Wassermann	1,545
Malaria smears	551
Widals	2
Blood matchings	93
Bloods for undulant fever	2
Fixation tests for gonorrhea	6
Vaginal smears	14
Vaginal cultures	1

Pus

Cultures	64
Smears	68
Smears for tubercle bacilli	19
Guinea pig inoculations	1
Throat cultures	3
Smears for gonococci	5

Spinal Fluid

Cell counts	25
Proteins	23
Cultures	12
Sugars	12
Pandy's	1
Differential counts	5
Smears	3
Smears for tubercle bacilli	6
Guinea pig inoculations	2
Chlorides	3
Globulins	2
Concentrations	1

Sputum

Smears for tubercle bacilli	930
Concentrations	753
Gram stains	24
Pneumococcus typings	16
Guinea pig inoculations	35
Cultures	16
Vincent's cultures	1
Vincent's smears	5

Pleural Fluid

Cultures	69
Smears	69
Smears for tubercle bacilli	81
Differential counts	45
Concentrations	59
Specific gravity	7
Guinea pig inoculations	12

Urine

Routine chemical and microscopical	2,941
Kidney functions	256
Cultures	80
Stained smears	83
Quick liver tests	11
Concentrations	44
Aschheim-Zondek tests	3
Guinea pig inoculations	4
Smears for tubercle bacilli	6
Typhoid cultures	3
Sugar	30
Occult blood	25
Diacetic acid	10
Quantitative sugar	4
Melanin	1
Special chemical	81
Uric acid	1

Feces

Occult blood	82
Parasites	16
Typhoid cultures	14
Smears for tubercle bacilli	1
Cultures	2

Stomach Contents

Smears for tubercle bacilli	118
Guinea pig inoculations	209
Concentrations	269
Occult blood	73
Routine chemical	19
Gastric analysis	17

Abdominal Fluid

Smear	1
Culture	1

Bronchus

Smear for tubercle bacilli	1
Concentration test for tubercle bacilli	1
Guinea pig inoculation	1

Pericardial Fluid

Smear	1
Culture	1

Thoracentesis

Smear	1
Culture	1
Smear for tubercle bacilli	2

Tissue

Guinea pig inoculation	35

Pathology:

Surgical Specimens	1,758
Autopsies—Total	73
Microscopic Sections (Frozen)	75
Microscopic Sections (Paraffin)	8,667
Basal Metabolic Tests	30
Ferguson Tests	6
Total	33,357

Dental Report

Prophylactic treatments	155
Fillings (permanent teeth)	502
Extractions (permanent teeth)	442
Extractions (temporary teeth)	7
Treatments	110
Restorations	19
Irrigations	20
Dental examinations	167
Total operations	1,422
Total visits	1,226
Total operating hours	1,470

Statistical Tables

Table 1.—*Admissions and Discharges*

Tuberculosis Patients

	Males	Females	Totals
Patients in Sanatorium Nov. 30, 1939	80	96	176
Patients admitted Dec. 1, 1939, to Nov. 30, 1940, inc.	78	93	171
Patients discharged Dec. 1, 1939, to Nov. 30, 1940, inc.	91	87	178
Deaths (included in number discharged)	24	10	34
Patients remaining in Sanatorium Nov. 30, 1940	67	102	169
Daily average number of patients	71.3	97.8	169.1

Cancer Patients

	Males	Females	Totals
Patients in hospital Nov. 30, 1939	21	18	39
Patients admitted from Dec. 1, 1939, to Nov. 30, 1940, inc.	302	414	716
Patients discharged from Dec. 1, 1939, to Nov. 30, 1940, inc.	305	407	712
Deaths (included in number discharged)	55	29	84
Patients remaining in hospital Nov. 30, 1940	18	25	43
Daily average number of patients	20.4	23.8	44.3

Total of Tuberculosis and Cancer Patients

	Males	Females	Totals
Patients in Sanatorium Nov. 30, 1939	101	114	215
Patients admitted Dec. 1, 1939, to Nov. 30, 1940, inc.	380	507	887
Patients discharged Dec. 1, 1939, to Nov. 30, 1940, inc.	396	494	890
Deaths (included in number discharged)	79	39	118
Patients remaining in Sanatorium Nov. 30, 1940	85	127	212
Daily average number of patients	91.7	121.6	213.4

Table 2.—*Cancer Readmissions*

	Males	Females	Totals
Total patients treated	323	432	755
Less old patients readmitted first time since Dec. 1, 1939	65	75	140
Less other readmissions	30	29	59
Less patients in hospital Dec. 1, 1939	21	18	39
New patients admitted from Dec. 1, 1939, to Nov. 30, 1940	207	310	517
Total number different patients treated Dec. 1, 1939, to Nov. 30, 1940.	293	403	696

Table 3.—*Diagnosis and Stage of Disease on Admission—Tuberculosis*

	Males	Females	Totals	Percentages
Advanced	31	36	67	39.2
Advanced with silicosis	–	1	1	.6
Minimal	6	18	24	14.0
Moderately advanced	20	24	44	25.7
Moderately advanced with basal cell carcinoma	1	–	1	.6
No evidence of tuberculosis	3	2	5	2.9
Pleurisy with effusion	5	1	6	3.5
Unclassified	12	11	23	13.5
	78	93	171	100.0

Source of Referral of Patients Admitted—Tuberculosis

Private practitioners	25
Sanatorium consultation clinics or outpatient departments	130
General hospitals and their outpatient departments	11
Other tuberculosis hospitals (by transfer)	5

Reason for Initial Examination of Tuberculous Patients Admitted

Contact with a person having tuberculosis	30
Suspicious symptoms or signs	139
Routine examination (school, industry, etc.)	2

Stage of Disease on Admission—Cancer

	Males	Females	Total
Early	12	37	49
Moderately advanced	67	101	168
Advanced	95	86	181
Nonmalignant	33	86	119
	207	310	517

Table 4.—*Ages of New Patients Admitted*

	Tuberculosis			Cancer			Combined Total
	Males	Females	Total	Males	Females	Total	
Under 20 years	7	11	18	5	4	9	27
20 to 29 years	17	49	66	3	6	9	75
30 to 39 years	14	16	30	9	33	42	72
40 to 49 years	17	8	25	25	94	119	144
50 to 59 years	11	7	18	57	78	135	153
60 to 69 years	12	2	14	59	62	121	135
70 to 79 years	–	–	–	40	28	68	68
80 to 89 years	–	–	–	9	4	13	13
90 to 99 years	–	–	–	–	1	1	1
	78	93	171	207	310	517	688

Table 5.—*Residence of New Patients Admitted*

Tuberculosis Patients

Agawam	6	Greenfield	2	North Adams	1	West Springfield	8
Amherst	1	Hatfield	2	Northampton	2	Wilbraham	1
Belchertown	7	Holyoke	43	Palmer	4	Williamsburg	1
Chicopee	23	Huntington	1	Pittsfield	6	Williamstown	1
Deerfield	1	Lee	1	Russell	1		
Dalton	1	Ludlow	6	Shelburne	1	Total	171
Easthampton	6	Marlborough	1	South Hadley	2		
Granby	1	Monson	1	Springfield	21		
Great Barrington	1	New Marlborough	1	Westfield	17		

Cancer Patients

Adams	5	Gill	1	Montague	4	Sunderland	1
Agawam	8	Granby	2	New Marlborough	1	Templeton	1
Amherst	4	Granville	1	North Adams	20	Wales	1
Athol	6	Great Barrington	1	Northampton	11	Ware	4
Bernardston	1	Greenfield	6	Orange	4	Warren	2
Blandford	1	Hadley	1	Palmer	12	West Brookfield	2
Charlemont	1	Hampden	1	Pittsfield	15	Westhampton	1
Chester	3	Hardwick	2	Reading	1	Westfield	46
Chesterfield	1	Hatfield	3	Royalston	1	Whately	1
Chicopee	45	Hawley	1	Sandisfield	1	West Springfield	19
Clarksburg	1	Holyoke	45	Savoy	1	West Stockbridge	3
Cummington	1	Huntington	2	Shelburne	4	Williamsburg	2
Dudley	1	Lenox	2	Sheffield	1	Winchendon	6
Easthampton	17	Longmeadow	3	South Hadley	2	State Institutions	19
East Longmeadow	6	Ludlow	4	Southampton	3		
Erving	1	Monroe	1	Southwick	1	Total	517
Gardner	1	Monson	3	Springfield	145		

Table 6.—*Condition of Patients Discharged—Tuberculosis*

	Males	Females	Totals	Percentages
Apparently arrested	21	36	57	32.0
Quiescent	1	6	7	3.9
Improved	27	18	45	25.3
Unimproved	18	16	34	19.1
Died	24	10	34	19.1
No evidence of tuberculosis	0	1	1	.6
	91	87	178	100.0

Condition of Patients Discharged—Cancer

	Males	Females	Totals
Improved	167	270	437
Unimproved	83	108	191
Died	55	29	84
	305	407	712

Destination of Tuberculosis Patients Discharged Alive

Home	125
Other tuberculosis hospitals	6
Other institutions	13
	144

TABLE 7.—*Deaths by Length of Residence in Sanatorium—Tuberculosis Patients*

	Males	Females	Totals
Under 1 month	9	1	10
1 to 3 months	6	2	8
3 to 6 months	2	2	4
6 to 12 months	3	2	5
1 to 2 years	1	2	3
Over 2 years	3	1	4
	24	10	34

TABLE 8.—*Causes of Death—Tuberculosis Patients*

	Males	Females	Totals
Pulmonary tuberculosis	7	6	13
Pulmonary tuberculosis with tuberculous enteritis	3	2	5
Pulmonary tuberculosis with silicosis	1	–	1
Pulmonary tuberculosis with cardiac failure	3	–	3
Pulmonary tuberculosis with laryngeal tuberculosis	1	–	1
Pulmonary tuberculosis with pulmonary hemorrhage	–	1	1
Pulmonary tuberculosis with tuberculous enteritis, colitis and cerebral thrombosis	1	–	1
Pulmonary tuberculosis with bronchopneumonia	1	–	1
Pulmonary tuberculosis with secondary anemia	1	–	1
Pulmonary tuberculosis with acute suppurative cerebrospinal meningitis	1	–	1
Pulmonary tuberculosis, tuberculous laryngitis and tuberculous enteritis	1	–	1
Pulmonary tuberculosis with tuberculous meningitis	1	–	1
Pulmonary tuberculosis with brain abscess and basal cell carcinoma of right temple	1	–	1
Miliary tuberculosis of spleen and liver. Tuberculous enteritis	–	1	1
Carcinoma of lung	1	–	1
Glomerulonephritis, subacute. Fetal adenoma of thyroid	1	–	1
	24	10	34

TABLE 9.—*Cancer Diagnoses*

This table includes all new cases treated, both house patients and outpatients. In some instances, the same patient has been counted two or more times, according to the varying conditions presented.

	Males	Females	Totals
Carcinoma			
Buccal Cavity and Pharynx:			
Lip	21	2	23
Tongue	8	1	9
Mouth	9	1	10
Jaw bone	2	0	2
Pharynx	10	1	11
	50	5	55
Digestive organs and Peritoneum:			
Esophagus	13	0	13
Stomach	15	10	25
Rectum and anus	23	9	32
Intestines	11	6	17
Liver and biliary passages	4	2	6
Pancreas	4	0	4
	70	27	97

	Males	Females	Totals
Respiratory System:			
Larynx	5	–	5
Lung	14	2	16
	19	2	21
Uterus:			
Cervix	–	64	64
Other and unspecified sites	–	11	11
	–	75	75
Other Female Genital Organs:			
Ovary	–	10	10
Vagina	–	3	3
Vulva	–	5	5
	–	18	18
Breast	2	89	91

	Males	Females	Totals
Male Genital Organs:			
Scrotum	1	–	1
Prostate	8	–	8
Testes	1	–	1
Penis	4	–	4
	14	–	14
Urinary Organs:			
Kidney	3	2	5
Bladder	10	6	16
	13	8	21
Skin:			
Abdominal wall	2	0	2
Canthus	3	1	4
Chin	1	1	2
Ear	7	0	7
Eyelid	0	1	1
Face	29	18	47
Forehead	5	2	7
Nose	16	15	31
Scalp	0	1	1
Temple	5	5	10
Skin (other sites)	1	1	2
	69	45	114
Other and Unspecified Organs:			
Bone	1	0	1
Thyroid gland	0	1	1
Nasal cavity and accessory sinuses	2	0	2
Other and unspecified organs	12	3	15
Primary site unknown	6	0	6
	21	4	25
Lymphoblastoma:			
Lymphoma	2	3	5
Lymphosarcoma	4	1	5
Hodgkin's disease	1	4	5
	7	8	15
Leukemia	3	2	5
Hemangioendothelioma	–	1	1
Malignant Melanoma	1	–	1
Sarcoma			
Fibrosarcoma			
Back	1	1	2
Breast	–	1	1
Scapula	1	–	1
Thigh	–	1	1
Wrist and forearm	1	–	1
Leiomyosarcoma			
Uterus	–	1	1
Osteogenic sarcoma			
Tibia	1	–	1
Reticulum cell sarcoma			
Thigh	1	–	1
	5	4	9
Mixed Tumor			
Malignant (Parotid)	–	1	1
Nonmalignant Tumors			
Adenofibroma	–	7	7
Adenoma	2	1	3
Angioma	3	1	4
Cyst	3	19	22
Cystadenoma	1	4	5
Dermoid tumor	–	1	1
Fibroid tumor	–	14	14
Fibroma	4	–	4
Hemangioma	9	16	25
Leiomyoma	1	19	20
Lipoma	5	12	17
Melanoma, benign	1	–	1
Myxoma	–	1	1
Neurofibroma	1	–	1
Osteochondroma	1	–	1
Osteoma	1	1	2
Papilloma	12	18	30
Polyp	6	44	50
Tumor, nonmalignant	2	2	4
	52	160	212

	Males	Females	Totals
Rheumatism, Diseases of Nutrition and of the Endocrine Glands, Other General Diseases, and Avitaminoses			
Chronic rheumatism and other rheumatic diseases	14	2	16
Diabetes mellitus	5	11	16
Diseases of thyroid and parathyroid	5	12	17
Diseases of the adrenal glands	1	–	1
Other general diseases	–	1	1
	25	26	51
Diseases of the Blood and Blood-Forming Organs			
Anemia	2	4	6
Diseases of the Nervous System and Sense Organs			
Intracranial lesions of vascular origin	–	2	2
Mental diseases and deficiency	4	11	15
Epilepsy	2	–	2
Other diseases of the nervous system	5	2	7
Diseases of organs of vision	1	–	1
Diseases of the ear and mastoid process	–	1	1
	12	16	28
Diseases of the Circulatory System			
Chronic affections of the valves and endocardium	–	1	1
Diseases of the myocardium	12	29	41
Diseases of the coronary arteries and angina pectoris	1	1	2
Other diseases of the heart	6	2	8
Aneurysm	–	1	1
Arteriosclerosis	5	3	8
Diseases of the veins	9	8	17
Diseases of the lymphatic system	1	–	1
High blood pressure	2	11	13
Other diseases of the circulatory system	2	–	2
	38	56	94
Diseases of the Respiratory System			
Diseases of the nasal fossae and accessory sinuses	2	3	5
Diseases of the larynx	–	2	2
Bronchitis	2	1	3
Pleurisy	2	1	3
Hemorrhagic infarction, thrombosis, edema and chronic congestion of the lungs	3	1	4
Asthma	1	–	1
Other diseases of the respiratory system	8	6	14
	18	14	32

	Males	Females	Totals
Diseases of the Digestive System			
Diseases of the buccal cavity, pharynx, tonsils and adnexa	24	15	39
Diseases of the esophagus	6	–	6
Ulcer of stomach or duodenum	46	9	55
Other diseases of the stomach	8	9	17
Appendicitis	5	1	6
Hernia and intestinal obstruction	1	3	4
Other diseases of the intestines	20	19	39
Cirrhosis of the liver	3	1	4
Biliary calculi	1	1	2
Other diseases of the gallbladder and biliary ducts	6	26	32
	120	84	204
Diseases of the Genito-urinary System			
Nephritis unspecified	–	1	1
Other diseases of the kidneys and ureters	3	5	8
Calculi of the urinary passages	2	3	5
Diseases of the urinary bladder	4	2	6
Diseases of the urethra	1	7	8
Diseases of the prostate	11	–	11
Diseases of the male genital organs	1	–	1
Diseases of the female genital organs:			
Ovaries, Fallopian tubes and parametria	–	7	
Uterus	–	16	
Cervix	–	166	
Other and unspecified female genital organs	–	12	201
Diseases of the breast	9	42	51
	31	261	292

	Males	Females	Totals
Diseases of Pregnancy, Childbirth, and the Puerperium			
Abortion	–	2	2
Pregnancy	–	4	4
	–	6	6
Diseases of the Skin and Cellular Tissue			
Abscess	2	2	4
Other diseases of the skin and cellular tissue	14	12	26
Keratosis	11	14	25
Hyperkeratosis	2	–	2
	29	28	57
Diseases of the Bones and Organs of Movement			
Osteomyelitis	2	1	3
Other diseases of the bones	2	4	6
Diseases of the joints and other organs of movement	1	2	3
	5	7	12
Congenital Malformations			
Nevus	1	15	16
Infectious and Parasitic Diseases			
Tuberculosis of the respiratory system	10	5	15
Tuberculosis of the vertebral column	–	1	1
Tuberculosis of the skin and subcutaneous cellular tissues	1	1	2
Tuberculosis of the lymphatic system	2	4	6
Tuberculosis of the genitourinary system	–	1	1
Tuberculosis of other organs	1	–	1
Syphilis	6	10	16
Diseases due to filtrable viruses	–	1	1
	20	23	43
No Malignancy	96	95	191
Undiagnosed	22	16	38
Deferred	17	20	37

Financial Report, Westfield State Sanatorium, 1940

To the Department of Public Health:

I respectfully submit the following report of the finances of this institution for the fiscal year ending November 30, 1940:

Statement of Earnings

Board of patients:			
Private	$23,651 50		
Cities and towns	99,815 50		
		$123,467 00	
Sales:			
Food	$1,848 64		
Clothing and materials	6 00		
Furnishings and household supplies	27 82		
Medical and general care	872 83		
Heat, light and power	302 00		
Farm	1,506 60		
Total sales	$4,563 89		
Total earnings for the year			$128,030 89
Total cash receipts reverting and transferred to the State Treasurer			135,904 89
Accounts receivable outstanding Dec. 1, 1939		$35,404 50	
Accounts receivable outstanding Nov. 30, 1940		27,530 50	
Accounts receivable decreased			7,874 00

Maintenance Appropriation

Balance from previous year, brought forward		$2,746 98
Appropriation, current year	$432,250 00	
Reduced by Comptroller	*709 12*	
		431,540 88
Total		$434,287 86
Expenditures as follows:		
Personal services	$272,173 63	
Food	53,211 04	
Medical and general care	25,768 76	
Farm	10,268 68	
Heat, light and power	36,409 27	
Garage, stable and grounds	2,682 42	
Travel, transportation and office expenses	8,303 42	
Religious instruction	1,730 00	
Clothing and materials	1,411 45	
Furnishings and household supplies	7,681 05	
Repairs, ordinary	4,905 16	
Repairs and renewals	1,808 11	
Total maintenance expenditures		$426,352 99
Balance of maintenance appropriation, Nov. 30, 1939		$7,934 87
Estimated outstanding liabilities, Nov. 30, 1940		$2,712 38

Special Appropriations

Balance December 1, 1939, brought forward		$1,629 58
Appropriations for current year *Decrease of 12-26-39*		*791 62*
Total		$837 96
Expended during the year (see statement below)	$236 07	
Reverting to Treasury of Commonwealth	*601 89	
(Star balances below that are reverting)		837 96

Appropriation	Act or Resolve	Total Amount Appropriated	Expended during Fiscal Year	Total Expended to Date	Balance at End of Year
E.P.W. Construction P.W.A. Docket 1165, Mass. State Project H-102, Cancer and Tuberculosis Group	1938	$1,002,268 38	–	$1,001,864 25	$404 13
Fire Protection and Sprinklers	1938	1,100 00	236 07	1,056 58	43 42
Improvement to Water Supply System	1938	31,650 00		31,495 66	154 34
		$1,035,018 38	$236 07	$1,034,416 49	$601 89

Per Capita

During the year the average number of patients has been		213 38
Total cost of maintenance	$426,352 99	
Equal to a weekly per capita cost of (52 weeks to year)	38 424	
Total receipts for the year	135,904 89	
Equal to a weekly per capita of	12 248	
Total net cost of maintenance for year (total maintenance less total receipts)		$290,448 10
Net weekly per capita	26 176	

Respectfully submitted,

Josephine E. French,
Treasurer.

Financial Statement Verified

Walter S. Morgan, *Comptroller.*

Inventory: Westfield State Sanatorium

GRAND SUMMARY SHEET

November 30, 1940

Real Estate

Land, 266.07 acres	$11,021 00	
Buildings	1,299,609 17	
		$1,310,630 17

Personal Property Undistributed Supplies

(Total of Departmental Sheets)

Travel, transportation and office expenses	$100 00	
Food	3,972 47	
Clothing and materials	1,090 34	
Furnishings and household supplies	2,334 67	
Medical and general care	3,354 47	
Heat, light and power	1,440 08	
Farm	930 32	
Garage, stable and grounds	100 22	
Repairs	229 91	
Total		$13,552 48

Personal Property Distributed Supplies

(Total of Departmental Sheets)

Travel, transportation and office expenses		$8,040 90	
Clothing and materials		711 70	
Furnishings and household supplies		99,225 73	
Medical and general care		117,776 92	
Heat, light and power		2,743 89	
Farm:			
Livestock	$11,921 98		
All other	17,350 65		
		29,272 63	
Garage, stable and grounds		7,699 22	
Repairs		2,875 05	
Total			$268,346 04

Grand Summary

Real Estate—Total	$1,310,630 17	
Personal Property—Undistributed Supplies, Total	13,552 48	
Personal Property—Distributed Supplies, Total	268,346 04	
Total		$1,592,528 69

PONDVILLE HOSPITAL

George L. Parker, M.D., *Superintendent*

Report of the Superintendent

To Paul J. Jakmauh, M.D., *Commissioner, Department of Public Health:*

I have the honor to submit the fourteenth annual report of the Pondville Hospital for the year ending November 30, 1940.

Financial Statement

During the year, there has been expended for maintenance $349,029.78, a gross weekly per capita cost of $52.64. There has been collected from miscellaneous sources $77,797.62 (the total of all collections). Deducting this amount from the gross maintenance leaves a net expense of $271,232.16. The net weekly per capita cost was $40.91. There has been collected from private patients and Old Age Assistance cases $33,461.67, from cities and towns $41,595.92, from the outpatient department $792.00, from accident cases $28.50, and from miscellaneous sales and other sources $1,812.32, and reimbursement from the State Board of Retirement $107.21.

Seven hundred and fifteen patients were supported by private funds, 667 by cities and towns, and 118 by the State, leaving 10 settlements pending.

There has been expended from Special Appropriations allotted under the Acts of 1938 for Improvements to Water Supply System $184.38.

Population

There were 117 patients in the hospital on November 30, 1939. During the year there were 1,510 admissions. Of these, 546 were readmissions and 53 were received from other State institutions. One hundred patients remained at the hospital at the end of the year.

Discharges during the year were 1,527. The condition of 1,103 was improved, 267 unimproved, and 157 died. There were 99 autopsies.

The average period of hospitalization was 31.9 days. The smallest number in the hospital on any one day was 100, the largest number 145.

The average number of patients a day was 127.3. The daily average number of officers and employees was 196.4.

Medical Report

The weekly clinic at the hospital was continued through the year with 48 clinics held. Visits to the regular Thursday clinic numbered 4,638 with an average attendance of 96.6. Patients making their first visit to the clinic numbered 1,201. Outpatient visits other than the regular Thursday clinic numbered 3,040. Of these, 66 were new patients. The total clinic visits numbered 7,678, an increase of 11.2% over last year. There were 569 clinic patients who were subsequently admitted to the hospital. Although there was a decrease in the admission of patients of 4.3% over last year, the average period of hospitalization was 31.9 days, an increase of 0.6 days over last year. This is probably due to the type of cases we have had and increase in major surgical treatments.

There was an increase of 6.3% in major surgical operations and a decrease of 8.9% in minor operations. There was an increase of 17.9% in X-ray treatments.

The discharges (including deaths) decreased 4.2%. The number of deaths decreased 39.1%, and the number of autopsies decreased 44% over last year. The number of surgical specimens handled by the pathological department increased 16.7% as compared with last year.

X-Ray and Radium:

Diagnostic X-ray plates taken, 9,546; fluoroscopic examinations, 793; X-ray treatments, 12,555; radium treatments, 376.

Surgical Report

Operations: Major, 671; minor, 1,354; procedures without anesthetics, 885; total procedures, 2,910. Of these procedures, 638 were biopsies, 14 bronchoscopies, 341 cystoscopies, 32 esophagoscopies, 23 laryngoscopies, 121 proctoscopies, and 401 transfusions.

An anesthetic was given 2,025 times; Avertin, 1; cocaine, 55; ether, 8; ethyl chloride, 2; evipal, 33; gas-oxygen, 32; gas-oxygen-ether, 462; novocaine, 1,126; pantocaine, 4; pentothal, 103; spinal, 199.

Laboratory Report

Autopsies	99
Basal Metabolism Tests	84
Blood	
1. Bacteriology and Serology:	
Blood cultures	100
Blood grouping	1,032
Blood matching	651
Blood for Wassermann and Hinton	2,472
Complement fixation for gonorrhea	2
Quick Hintons	649
Widal	33
2. Chemistry:	
Albumen-globulin ratio	211
Ascorbic acid determinations	296
Blood chlorides	59
Blood diastase determinations	3
Calcium	11
Carbon dioxide combining power	21
Cholesterol	14
Creatinine	12
Galactose tolerance	1
Glucose tolerance	11
Nonprotein nitrogen	3,137
Phosphorus	11
Phosphatase	6
Sugar	206
Sulfanilamide	173
Sulfapyridine	45
Sulfathiazole	17
Total protein	86
Urea clearance test	1
Uric acid	47
3. Clinical Pathology:	
Bleeding time	21
Coagulation time	24
Differentials	2,546
Hematocrits	44
Hemoglobins	3,368
Icterus index	90
Mean corpuscular volume	8
Oxidase	1
Platelet counts	6
Prothrombin times	9
Red cell counts	3,317
Red cell fragility	2
Reticulocyte counts	43
Sedimentation tests	24
Takata-Ara tests	17
Van den Bergh tests	14
White cell counts	3,191
Feces	
Culture for tubercle bacilli	15
Bile	8
Feces cultures	7
Occult blood	489
Smears for tubercle bacilli, ova, etc.	37
Microscopic Sections	
Celloidin	4,032
Frozen	79
Paraffin	4,352
Miscellaneous Examinations	6
Nose, Throat, Mouth Cultures	111
Nose, Throat, Mouth Smears	111
Pleural Fluids	
Ascitic fluid	1
Cultures	32
Diastase	2
Heterophile antibody test	1
Inoculations	5
Red blood counts	2
Smears	33
Specific gravity	5
Total proteins	13
White blood counts	4
Pus Cultures	174
Pus Smears	175
Specimens sent from Sanatorium to Central Laboratory	2
Specimens sent to Lakeville	21
Spinal Fluids	
Cell counts	27
Chemical	42
Cultures	8
Hintons	7
Smears	18
Wassermann	16
Sputum	
Concentration	58
Cultures	56
Guinea pig inoculations	12
Neufeld pneumococcus typing	41
Smears	155
Stomach Contents	
Gastric analyses	76
Vomitus	3
Surgical Specimens	1,695
Urine	
Analysis of bladder stone	1
Creatinine determinations	11
Cultures	774
Kidney function test	530
Routine chemical and microscopical	6,338
Smears	774
Special chemical	221
Total nitrogen	6
Uric acid determinations	11
Vincent's Smears	6
Total	42,818

Dental Report

Prophylactic treatments, 93; extractions (permanent teeth), 768; treatments, 256; X-ray examinations, 321; examinations, 806. Total, 2,244. Total number of visits, 1,337; total number of patients, 806.

Institution Activities

The following program of clinics and meetings was held during the year:

May 13—Hospital Day celebration and special dinner for members of the Social Service Committee, patients, and employees.

May 23—Hospital Alumni Day.

Staff meetings were held monthly for the discussion of cases by the visiting and resident medical and surgical staffs. A series of lectures by members of the visiting staff and resident staff made the work more interesting for the hospital personnel. Throughout the year, groups of students from Harvard, Tufts, Boston University and Middlesex Medical School attended our outpatient clinics.

Good fellowship among our employees has been stimulated by card parties, dances, and organized outdoor sports such as tennis and baseball. Our employees have continued to enjoy the use of the bowling alleys through the courtesy of the Superintendent of the Wrentham State School.

Improvements and Changes

Emergency Power Plant repairs such as installation of a new steel header with steel pipes and valves was completed.

The roofs of the Men's Dormitory and Cottage C were reshingled.

A new deep therapy X-ray unit was added to the Roentgenological Department.

One section of Ward A was renovated with the installation of new radio outlets and a nurses' call system.

Equipment such as surgical instruments, mattresses, linen, filing cabinets, laboratory equipment, and kitchen equipment has been replaced where necessary.

A Pontiac Sedan has replaced our old Buick Sedan, and a new Pontiac Beach Wagon has been added to our garage equipment.

Recommendations

The condition of our boiler plant is a serious one. Although emergency repairs have been made this current year, the boilers are at least twenty-five years old and the equipment becomes more inefficient each year. The addition of any new buildings to the institution, so the Engineer advises, will necessitate the construction of a new Power Plant. I, therefore, again strongly urge that an allowance be made to remedy this situation.

The housing accommodations for our employees have not expanded with the hospital and the increase in personnel. This situation becomes more serious each year, and something must be done as many of the present employees' quarters are a fire hazard. Again, I earnestly request the construction of a hundred-bed female employees' dormitory which would solve our present housing problem.

Five years ago our Recreation Building, a former laundry, was condemned by the Department of Public Safety. This has eliminated the parties and dances at the institution formerly enjoyed by the employees and the motion pictures enjoyed by both patients and employees.

During the past two years, most of the offices in our Administration Building and in the hospital laboratories have become overcrowded for efficiency. A new Administration Building with business and executive offices, pathological, bacteriological, and biological departments, animal research laboratory and recreation hall would solve our problems and would give us the old building for expansion of the record office and space for a small employees' infirmary. At the present time our employees are cared for on the wards with the cancer patients. Again, I earnestly request that funds be appropriated to remedy this situation.

The condition of our roads to and around the hospital has become a serious problem. The roads have long been in urgent need of repair. This last year over 1,500 patients were admitted to and discharged from the hospital, and 7,678 patients visited our outpatient department, to say nothing of the thousands of people who come here to visit the patients during the year. Therefore, with this amount of traffic coming to and going from the hospital, I feel that sufficient funds should be allowed not only for repairs to the roads, but for additional street lighting equipment which is so necessary.

There are still three employees' cottages, the roofs of which are leaking badly because the asbestos shingles now covering the roofs are cracked and porous. I, therefore, request that an allowance be made for the reshingling of the roofs of these cottages.

The appropriation allotted to new floor coverings this year could not be used because of the emergency boiler plant repairs. I, therefore, request that an appropriation be made to replace the floor coverings throughout Ward A and some of the living quarters of our employees.

Each year some of the permanent equipment is replaced, but the situation still is most unsatisfactory. Bedpan sterilizers and new lavatory pipes and fixtures are needed in the wards and employees' cottages. Many of the old iron hospital beds should be replaced with modern surgical beds. I, therefore, respectfully request that an appropriation be made to continue these replacements. The sulphur dioxide Kelvinator refrigeration equipment on our wards and in our mortuary is ten years old and much of it is obsolete and beyond repair. Continued use of this equipment is dangerous to the welfare of our patients. I hereby request funds with which to rectify this condition.

There still exists a fire hazard around the hospital grounds which could not be cleared following the hurricane two years ago. I, therefore, respectfully request that funds be made available to remedy this situation.

Our garage accommodations are still very inadequate. Again, I recommend that a garage be constructed for the use of employees who own cars. A monthly charge for each car would eventually make the project self-sustaining.

Acknowledgments

I wish to express my appreciation to our clergymen for their cooperation and good work in ministering to the spiritual needs of our patients.

To the members of the Social Service Committee, to the Ladies' Society of the Wrentham Congregational Church who have given so freely of their time and resources, and to the various Women's Clubs who have assisted us in any way, I am deeply indebted.

I am deeply grateful to the numerous groups of choir singers and the Norwood American Legion Band who have rendered musical programs for our patients.

To the medical staff, nurses, and all other employees, I again wish to express my appreciation for the support, cooperation, and loyalty given me.

I wish to thank you and other members of the Department for your confidence and assistance throughout the year.

Respectfully submitted,

George L. Parker, M.D.,
Superintendent.

Statistical Tables

Table 1.—*Admissions and Discharges*

	Males	Females	Total
Patients in hospital December 1, 1939	57	60	117
Patients admitted from December 1, 1939, to November 30, 1940, inclusive	685	825	1,510
Patients discharged from December 1, 1939, to November 30, 1940, inclusive	693	834	1,527
Patients remaining in hospital November 30, 1940	53	47	100
Daily average number of patients	63.3	64.0	127.3
Deaths (included in number discharged)	88	69	157

Table 2.—*Readmissions*

	Males	Females	Total
Total patients treated	742	885	1,627
Less old patients readmitted first time since December 1, 1939	104	133	237
Less other readmissions	154	155	309
Less patients in hospital December 1, 1939	57	60	117
Number of new patients admitted from December 1, 1939, to November 30, 1940	427	537	964
Total number of different patients treated December 1, 1939, to November 30, 1940	588	730	1,318

Table 3.—*Age of New Patients Admitted*

	Males	Females	Total
Under 20 years	4	5	9
20 to 29 years	14	19	33
30 to 39 years	13	61	74
40 to 49 years	40	129	169
50 to 59 years	109	118	227
60 to 69 years	126	110	236
70 to 79 years	91	71	162
80 to 89 years	28	20	48
90 to 99 years	3	2	5
Unknown age	1	–	1
Totals	429	535	964

Table 4.—*Residence of New Patients Admitted*

Abington	6	Fairhaven	4	Medway	7	Seekonk	4
Acushnet	4	Fall River	49	Melrose	2	Sharon	2
Amesbury	5	Falmouth	3	Methuen	9	Sherborn	2
Andover	2	Fitchburg	9	Middleborough	19	Shrewsbury	1
Arlington	1	Foxborough	17	Milford	24	Somerset	4
Ashburnham	3	Framingham	8	Millis	5	Somerville	2
Ashland	1	Franklin	16	Millville	2	Southbridge	1
Athol	3	Gardner	6	Milton	1	Spencer	1
Attleboro	44	Georgetown	1	Nahant	1	Stoughton	1
Avon	1	Gloucester	4	Natick	5	Sutton	1
Barnstable	6	Grafton	7	Needham	3	Swansea	2
Bellingham	5	Groveland	1	New Bedford	40	Taunton	59
Belmont	1	Halifax	1	Newburyport	3	Templeton	6
Berkley	4	Hanover	2	Newton	2	Tisbury	2
Berlin	1	Hanson	3	Norfolk	4	Townsend	1
Beverly	1	Harwich	2	North Andover	1	Upton	5
Blackstone	1	Haverhill	22	North Attleborough	22	Uxbridge	6
Boston	31	Hingham	1	Northborough	3	Wakefield	1
Braintree	5	Holbrook	3	Northbridge	2	Walpole	13
Brewster	1	Holliston	6	Norton	7	Waltham	4
Bridgewater	4	Hopedale	2	Norwell	2	Wareham	2
Brockton	32	Hopkinton	2	Norwood	17	Watertown	1
Brookline	2	Hubbardston	1	Oak Bluffs	1	Webster	2
Cambridge	7	Hudson	2	Oxford	1	Wellfleet	1
Canton	1	Ipswich	2	Peabody	1	Westborough	2
Charlton	2	Kingston	3	Pembroke	4	Westport	3
Chelmsford	1	Lakeville	3	Petersham	1	Westwood	6
Chelsea	3	Lawrence	22	Plainville	2	Weymouth	8
Danvers	2	Leicester	1	Plymouth	5	Whitman	8
Dedham	14	Leominster	3	Quincy	4	Wilmington	1
Dighton	2	Lowell	9	Randolph	4	Winchendon	2
Dover	1	Lynn	12	Raynham	6	Winthrop	1
Douglas	2	Malden	3	Reading	3	Woburn	3
Dracut	1	Mansfield	22	Rehoboth	4	Worcester	18
Dudley	1	Marblehead	1	Revere	1	Wrentham	8
Duxbury	5	Marion	1	Rochester	1	Yarmouth	1
East Bridgewater	1	Marlborough	2	Rockland	5	State Institutions	53
Eastham	1	Marshfield	3	Salem	1		
Easton	9	Maynard	3	Salisbury	2	Total	964
Edgartown	1	Medfield	4	Saugus	1		
Everett	9	Medford	4	Scituate	1		

Table 5.—*Stage of Disease of New Patients Admitted*

	Males	Females	Total
Early	79	58	137
Moderately advanced	146	131	277
Advanced	122	145	267
Nonmalignant	77	201	278
No diagnosis	3	2	5
Totals	427	537	964

Table 6.—*Condition of Patients Discharged*

	Males	Females	Total
Improved	477	626	1,103
Unimproved	128	139	267
Died	88	69	157
Totals	693	834	1,527

Table 7.—*Diagnoses*

This table includes all new cases treated, both house patients and outpatients. In some instances, the same patient has been counted two or more times, according to the varying conditions presented.

	Males	Females	Total
Carcinoma			
Buccal Cavity and Pharynx:			
Buccal cavity	18	4	22
Floor of mouth	3	1	4
Jaw	2	–	2
Lip	46	2	48
Palate	8	–	8
Pharynx	11	–	11
Salivary gland	1	–	1
Throat	1	–	1
Tongue	28	3	31
Tonsil	5	–	5
	123	10	133
Digestive Tract and Peritoneum:			
Anus	–	2	2
Cecum	1	4	5
Colon	5	6	11
Duodenum	1	–	1
Esophagus	17	–	17
Gall bladder	1	–	1
Pancreas	2	1	3
Rectum	37	25	62
Sigmoid	2	5	7
Stomach	28	9	37
	94	52	146
Respiratory system:			
Bronchus	1	–	1
Epiglottis	2	1	3
Larynx	6	1	7
Lung	14	1	15
Nasal cavity	1	1	2
Nasopharynx	4	–	4
	28	4	32
Female Genital Organs:			
Cervix	–	81	81
Ovary	–	17	17
Uterus	–	29	29
Vagina	–	2	2
Vulva	–	6	6
	–	135	135
Breast	–	102	102
Male Genitourinary Organs:			
Bladder	20	–	20
Kidney	2	–	2
Penis	4	–	4
Prostate	15	–	15
Scrotum	1	–	1
Testicle	2	–	2
	44	–	44
Skin:			
Ear	2	16	18
Eyelid	5	1	6
Face	54	22	76
Nose	36	21	57
Scalp	–	1	1
Temple	12	4	16
Other sites	33	9	42
	142	74	216
Other and Unspecified Organs:			
Antrum	1	–	1
Female bladder	–	6	6
Branchiogenic	1	–	1
Eye and orbit	1	–	1
Frontal sinus	–	1	1
Hemorrhoid	–	1	1
Female kidney	–	2	2

	Males	Females	Total
Other and Unspecified Organs:—Continued			
Neck, primary site unknown	–	2	2
Parotid	–	1	1
Thyroid	–	1	1
Other sites	14	6	20
	17	20	37
Lymphoblastoma, Lymphosarcoma, Hodgkin's Disease	8	13	21
Leukemia	4	4	8
Malignant Melanoma			
Cheek	1	–	1
Chest	1	–	1
Foot	–	1	1
Forearm	–	1	1
Toe	–	1	1
Primary site unknown	1	1	2
	3	4	7
Sarcoma			
Chondrosarcoma:			
Hip	1	–	1
Fibrosarcoma:			
Foot	–	1	1
Groin	1	–	1
Hand	–	1	1
Shoulder	1	–	1
Leukosarcoma:			
Mediastinum	1	–	1
Leiomyosarcoma:			
Stomach	1	–	1
Osteogenic Sarcoma and Ewing's Endothelioma:			
Frontal bone	1	–	1
Humerus	1	–	1
Pubic bone	1	–	1
Osteosarcoma (Chondromyxomatous Type):			
Femur	1	–	1
Reticulum Cell Sarcoma:			
Spine	–	1	1
	9	4	13
Myoblastoma			
Tongue	1	–	1
Neuroblastoma			
Vertebrae	–	1	1
Nonmalignant Tumors			
Adenofibroma	–	6	6
Adenoma	–	4	4
Adenomyoma	–	1	1
Chondromyoma	1	–	1
Cyst	7	5	12
Cystadenoma	1	2	3
Dermoid cyst	–	3	3
Fibroma	3	8	11
Fibromyoma	–	7	7
Granuloma	1	–	1
Hemangioma	7	2	9
Hematoma	–	2	2
Leiomyoma	–	33	33
Lipoma	7	13	20

	Males	Females	Total
Nonmalignant Tumors—Continued			
Mixed tumor	1	2	3
Myoma	–	9	9
Neurofibroma	1	1	2
Osteochondroma	2	–	2
Papilloma	13	7	20
Polyp	10	34	44
Xanthoma	–	1	1
Tumor, nature unknown	3	8	11
	57	148	205
Infectious and Parasitic Diseases			
General	11	14	25
Syphilis	18	8	26
Trichomonas vaginitis	–	1	1
Tuberculosis	15	12	27
	44	35	79
Rheumatic and Nutritional Diseases, Diseases of Endocrine glands, etc.			
General	5	14	19
Diabetes	3	10	13
Thyroid	2	5	7
	10	29	39
Diseases of Blood and Blood-Forming Organs	7	8	15
Diseases of the Nervous System and Organs of Special Sense			
General	10	6	16
Ear and mastoid	–	1	1
Organs of vision	–	2	2
	10	9	19
Diseases of Circulatory System	42	50	92
Diseases of Respiratory System	44	23	67
Diseases of Digestive System			
Buccal cavity	8	11	19
Leukoplakia	29	2	31
Esophagus	4	4	8
Ulcers of stomach and duodenum	37	10	47
Stomach	9	3	12
Hernia and intestinal obstruction	8	6	14
Other diseases of intestines	24	28	52

	Males	Females	Total
Diseases of Cirulatory System—Cont.			
Cholelithiasis	8	4	12
Other diseases of gall bladder	1	12	13
Appendicitis	–	2	2
Liver	10	4	14
Peritonitis	3	2	5
Pancreas	4	1	5
Diarrhea and enteritis	1	–	1
	146	89	235
Diseases of Genitourinary System			
Chronic nephritis	2	1	3
Nephritis, unspecified; uremia	5	3	8
Other diseases of kidneys and ureters	2	6	8
Hydronephrosis	6	19	25
Pyelonephritis	3	4	7
Calculi of urinary passages	2	2	4
Diseases of bladder	3	9	12
Diseases of urethra, urinary abscess, etc.	–	5	5
Diseases of prostate	7	–	7
Male genital organs	10	–	10
Female genital organs	–	138	138
Cysts of ovary	–	17	17
Breast	–	42	42
	40	246	286
Diseases of Skin and Cellular Tissue			
Cornu cutaneum	–	2	2
Keloid	2	1	3
Keratoses	47	47	94
Hyperkeratoses	1	–	1
Sebaceous cyst	2	2	4
Verruca	4	2	6
General	22	11	33
	78	65	143
Diseases of Bones, Joints and Organs of Locomotion	11	6	17
Congenital Malformations	7	10	17
Other Conditions	7	15	22
Deferred Cases	17	22	39
No Malignancy	73	39	112
No Pathology	6	14	20
No Diagnosis	9	25	34

Financial Report, Pondville Hospital at Norfolk, 1940

To the Department of Public Health:

I respectfully submit the following report of the finances of this institution for the fiscal year ending November 30, 1940:

Statement of Earnings

Board of patients:			
Private	$42,281 75		
Cities and towns	36,817 92		
Outpatient department	793 50		
Accident cases	28 50		
		$79,921 67	
Personal services:			
Reimbursement from Board of Retirement		$107 21	
Sales:			
Travel, transportation and office expenses	$0 72		
Food	381 03		
Furnishings and household supplies	89 38		
Medical and general care	299 74		
Garage, stable and grounds	12 00		
Repairs, ordinary	1 43		
Miscellaneous—junk	267 37		
Board—special nurses	64 00		
Total sales		$1,115 67	
Miscellaneous:			
Board and Room	$720 66		
Total, miscellaneous		$720 66	
Total earnings for the year			$81,865 21
Total cash receipts reverting and transferred to the State Treasurer			77,752 12
Accounts receivable outstanding Dec. 1, 1939		$64,159 49	
Accounts receivable outstanding Nov. 30, 1940		68,272 58	
Accounts receivable increased			4,113 09

Maintenance Appropriation

Balance from previous year, brought forward		$960 95
Appropriation, current year	$357,550 00	
Reduced Chap. 387, Acts 1939	*1,368 19*	
		356,181 81
Total		$357,142 76
Expenditures as follows:		
Personal services	$213,611 86	
Food	48,532 72	
Medical and general care	28,180 14	
Heat, light and power	15,445 88	
Garage, stable and grounds	2,996 38	
Travel, transportation and office expenses	10,140 61	
Religious instruction	1,200 00	
Clothing and materials	906 74	
Furnishings and household supplies	18,055 24	
Repairs, ordinary	2,052 93	
Repairs and renewals	7,907 28	
Total maintenance expenditures		$349,029 78
Balance of maintenance appropriation, Nov. 30, 1940		$8,112 98
Estimated outstanding liabilities, Nov. 30, 1940		None

Special Appropriations

Balance December 1, 1940, brought forward		$493 70
Expended during the year (see statement below)	$184 38	
Reverting to Treasury of Commonwealth	*309 32	493 70
(Star balances below that are reverting)		

Appropriation	Act or Resolve	Total Amount Appropriated	Expended during Fiscal Year	Total Expended to Date	Balance at End of Year
Water Supply	Chap. 356–1938	$3,000 00	$184 38	$2,980 56	$19 44
Improvements—Sewage Disposal	356–1938 1937–1936	8,000 00	–	7,710 12	289 88
		$11,000 00	$184 38	$10,690 68	$309 32

Per Capita

During the year the average number of patients has been		127 5
Total cost of maintenance	$349,029 78	
Equal to a weekly per capita cost of (52 weeks to year)	52 64	
Total receipts for the year	77,752 12	
Equal to a weekly per capita of	11 72	
Total net cost of maintenance for year (total maintenance less total receipts)		271,277 66
Net weekly per capita	40 92	

Respectfully submitted,

Marion M. Whalen,
Treasurer.

Financial Statement Verified.

Approved—Walter S. Morgan, *Comptroller.*

Inventory: Pondville Hospital at Norfolk

GRAND SUMMARY SHEET

November 30, 1940

Real Estate

Land, 255.5 acres	$13,840 00	
Buildings	*712,137 39	
Betterments (additions and improvements)	7,032 71	
Total, Real Estate		$725,977 39

Personal Property Undistributed Supplies

(Total of Departmental Sheets)

Travel, transportation and office expenses	$3,102 74	
Food	3,155 03	
Clothing and materials	2,206 25	
Furnishings and household supplies	3,990 98	
Medical and general care	28,289 12	
Heat, light and power	1,426 70	
Garage, stable and grounds	189 77	
Repairs	8,531 00	
Total		50,891 59

Personal Property Distributed Supplies

(Total of Departmental Sheets)

Travel, transportation and office expenses	$5,269 87	
Clothing and materials	1,489 34	
Furnishings and household supplies	72,051 72	
Medical and general care	124,004 13	
Heat, light and power	1,073 10	
Garage, stable and grounds	8,307 63	
Repairs	3,213 81	
Total		215,409 60
Less 5% depreciation		10,770 48
		$204,639 12

Grand Summary

Radium in Emanation Plant	$69,880 30	
Real Estate—Total	725,977 39	
Personal Property—Undistributed Supplies, Total	50,891 59	
Personal Property—Distributed Supplies, Total	204,639 12	
Total		$1,051,388 40

* Betterments and additions and improvements included in this amount.

INDEX